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Collection and Analysis of Specific Elint Signal Parameters

EAAF

Technical Memorandum No. 1

June 23, 1985

by

Dr. Bonnie Wilson

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20. ABSTRACT (Continue on reverse side if necessary and identify by block number) This is one of a series of algorithm analysis reports performed for the US Army Intelligence Center and School covering selected algorithms in existing or planned Intelligence and Electronic Warfare (IEW) systems. This report describes configuration and operation of a data collection and reduction system to produce information on the distributions characteristic of ELINT parameter measurements. The system was designed and built and data		

on a real radar collected to verify adequacy of the hardware, software and methodology. The report includes description of the hardware, copies of the software source code, description of the data collection methodology and the results of the initial data collection and reduction against the selected radar.

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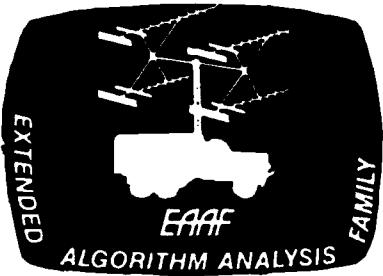
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PREFACE

The work described in this publication was sponsored by the United States Army Intelligence Center and School. The writing and publication of this paper was supported by the Jet Propulsion Laboratory, California Institute of Technology, under a contract with the National Aeronautics and Space Administration.

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COLLECTION AND ANALYSIS OF SPECIFIC ELINT SIGNAL PARAMETERS

EAAF

Technical Memorandum No. 1

June 23, 1985

by

Dr. Lonnie Wilson

JET PROPULSION LABORATORY
California Institute of Technology
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Preliminary

UNCLASSIFIED

**COLLECTION AND ANALYSIS OF
SPECIFIC ELINT SIGNAL PARAMETERS:**

FINAL REPORT

JUNE 1985

BY:

**ELECTRONIC SYSTEMS
22560 Murietta Road
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Addendum

TABLE ONE

ELINT PARAMETER ANALYSIS - FREQUENCY

DATA STATISTICAL SET PARAMETER	P11FA	P11FB	P11F1	P11F2
MEAN VALUE (MHz)	410.92	410.96	410.20	410.07
MEDIUM VALUE (MHz)	410.77	410.68	410.10	409.93
DATA RANGE (MHz)	0.49	0.57	0.4	0.3
STANDARD DEVIATION (MHz)	0.0904	0.089	0.069	0.051
COEFFICIENT OF SKEWNESS	-0.99	0.077	-1.79	0.130
COEFFICIENT OF KURTOSIS	10.86	3.03	20.03	2.94
CHI-SQUARED	<u>16.2(13c)</u> <u>30.1(15c)</u> <u>23.2(17c)</u> <u>56.0(19c)</u>	<u>30.6(17c)</u> <u>18.5(19c)</u> <u>31.1(21c)</u>	<u>47.3(15c)</u> <u>76.2(17c)</u> <u>20.0(19c)</u> <u>56.9(21c)</u>	<u>46.5(13c)</u> <u>24.9(15c)</u> <u>90.6(17c)</u> <u>152.4(19c)</u>
25 - 75 INTER-PERCENTILE RANGE MHz (approximate)	0.07(50%) 0.046(40%) 0.04(42%) 0.04(42%)			

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INTRODUCTION

This contract is for the development of test configurations and supporting software to facilitate the collection and analysis of specific ELINT signal parameters. The fixed price research and development contract is being performed by Electronic Systems under JPL Contract No. 957176.

Mr. James Gillis and Dr. Lonnie Wilson met on 29 March 1985 to initiate and coordinate the details of contract No. 957176. This early meeting satisfies the preliminary oral briefing requirement by Electronic Systems. Also, Mr. James Gillis and Dr. Lonnie Wilson met earlier to discuss the interim report which was submitted by Electronic Systems. This final report is submitted and reviewed on June 14, 1985. The Statement of Work section of this final report is a direct reproduction of Article 1, Statement of Work of the contract. In addition to the collection and analysis included in the SOW, Electronic Systems agreed to perform third and fourth central moment calculations and 25 through 75 interpercentile range calculations.

The following tasks have been completed and analysis results are being reported in the final report:

1. The ELINT Parameter Measurement Processor has been assembled.
2. Data collection software has been written and debugged.
3. Frequency, pulsewidth and PRI sampled data have been collected on a radar.
4. Data processing and analysis software has been written and debugged for all statistical and histogram analysis.

5. Statistical and histogram analysis have been performed
on frequency, pulsewidth, and PRI sampled data.

STATEMENT OF WORK

ARTICLE 1. STATEMENT OF WORK

- (a) The Contractor shall develop the test configurations and software for data collection and reduction for the Electronic Intelligence Parameter Distributions Task (ELINT). In the performance of this effort, the Contractor shall perform the following:
 - (1) Reduce the collected data to probability density functions and histograms.
 - (2) Collect and analyze the following ELINT signal parametrics:
 - (A) Pulse repetition interval (PRI).
 - (B) Pulse width (PW).
 - (C) Frequency (F).
 - (D) Data analysis shall also include the characterization of the data obtained from one (1) actual sensor.
 - (i) Characterization of data is needed to validate the collection and reduction software and procedures.
- (b) The Contractor shall provide the following oral briefings to JPL at the Contractor's facility:
 - (1) A Preliminary Oral Briefing describing the scope and method of the proposed analysis.
 - (2) An Interim Oral Briefing describing the analysis performed and the work accomplished.
 - (3) A Final Oral Briefing describing the analysis performed.
- (c) The Contractor shall provide the following documentation in a format which shall be mutually acceptable to JPL and the Contractor:
 - (1) Three (3) copies of an interim written report describing the results of the analysis performed under paragraph (a)(2).
 - (2) Three (3) copies of a final written report summarizing all work performed under this Contract.

ELINT PARAMETER MEASUREMENT PROCESSOR

An RF Electronic Counter sensor was employed to measure, collect, and analyze ELINT signal parameters associated with the AN/PPS-6 radar system. This actual ELINT or Electronic Support Measures (ESM) sensor with an accompanying RF to IF downconverted has been employed by several platforms to measure precision frequency and precision PRI parameters.

The complete ELINT sensor system employed for data collection and analysis under this contract is shown in figure 1. The RF/IF downconverter converts the RF input signal at 9.24 GHz to an IF signal at approximately 410 MHz. The wideband downconverter was specially designed not to color the signal waveform.

The HP 5345A Electronic Counter was used to collect and measure the ELINT parameters. The data collection, statistical data processing, and histogram software programs were written on the HP-85 microcomputer. Floppy discs are used to store data sets and results are plotted using the HP-7470A plotter.

The software programs developed for this analysis are:

1. **GETVAL Program** - This program is used to collect data with the RF Electronic Counter sensor.
2. **TPLOT Program** - The data samples are plotted as a function of time.
3. **HPLOT Program** - The data collected using GETVAL program can be analyzed in histogram form with this program.
4. **DATAS Program** - This program is used to compute the statistical parameters associated with the data.

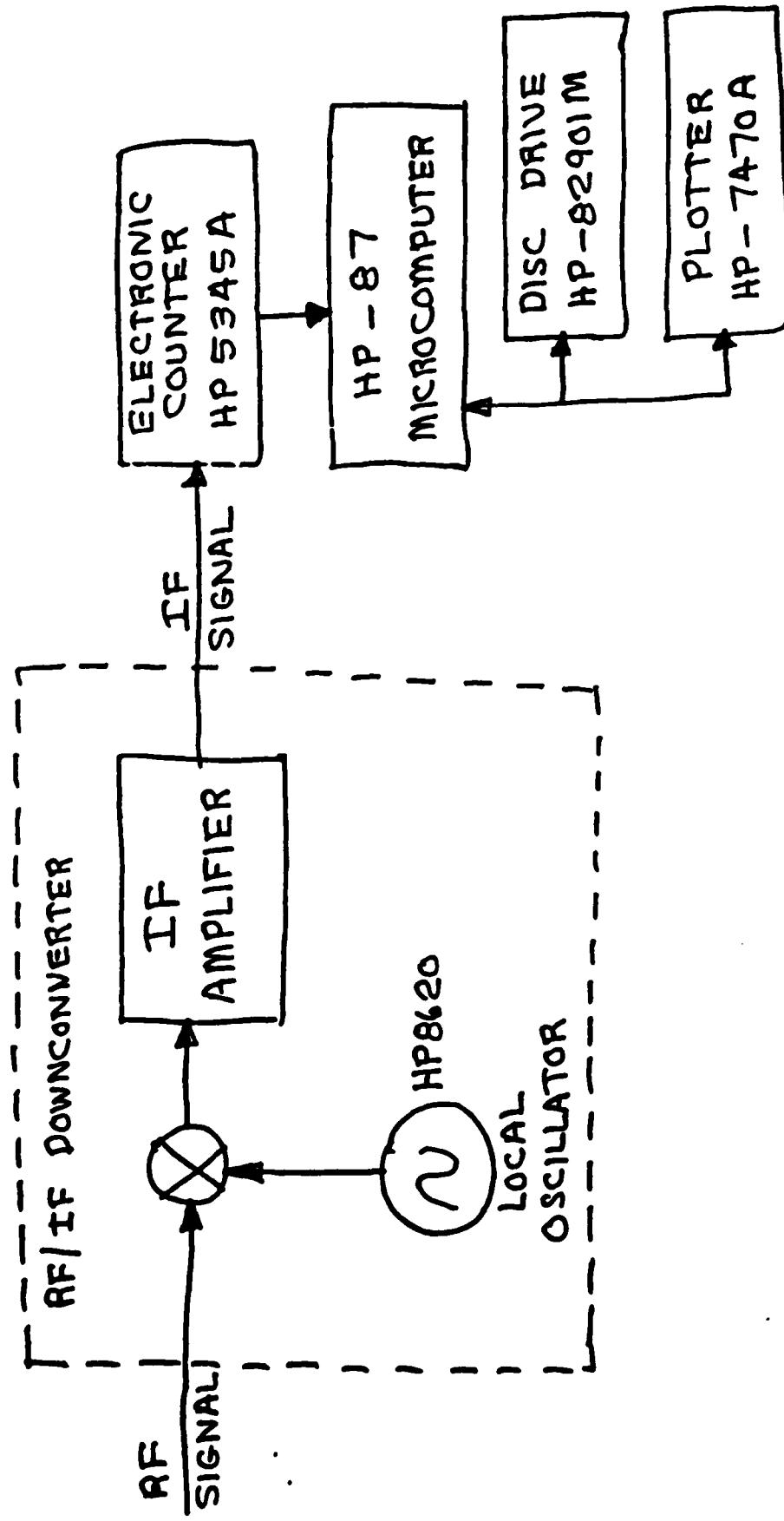


Figure 1. Simplified ELINT Sensor System using an RF Electronic Counter.

5. PRINTP Program - This program prints the statistical parameters derived from the DATAS Program.

6. HISTP Program - This program plots the theoretically expected histogram and the measured data histogram on one plot.

These computer software programs are listed in Appendix A of this report.

ANALYSIS ALGORITHMS

Statistical analysis of the radar parameter sampled values is performed using the following algorithms:

1. SAMPLED MEAN

\bar{x} = sampled mean

$$\bar{x} = \frac{1}{N} \sum_{i=1}^N x_i$$

where x_i = i th. measured value
N = total number of measured samples.

2. VARIANCE

σ^2 = Variance

$$= \frac{1}{N-1} \sum_{i=1}^N (x_i - \bar{x})^2$$

where $\frac{1}{N-1} \div \frac{1}{N}$

(N = 1000)

3. STANDARD DEVIATION

$$\sigma = \sqrt{\text{Variance}}$$

4. CENTRAL MOMENTS

The central moments are defined as the moments of the difference between a random variable and its mean value. The r th central moment is

$$CM_r = \frac{1}{N} \left[\sum_{i=1}^N (x_i - \bar{x})^r \right]$$

where

CM_2 = Variance

CM_3 = third central moment

CM_4 = fourth central moment.

The coefficient of skewness or symmetry is associated with the third central moment

$$CS = \frac{CM_3}{(CM_2)^{3/2}}$$

The coefficient of kurtosis is derived from the fourth central moment

$$CK = \frac{CM_4}{(CM_2)^2}.$$

5. GAUSSIAN pdf

$$p(x) = \frac{1}{\sqrt{2\pi}\sigma} \exp \left[-\frac{1}{2} \left(\frac{x-\mu}{\sigma} \right)^2 \right]$$

where

μ = mean value

σ = standard deviation

6. GOODNESS OF FIT TEST

A "goodness of fit" test can be made by comparing an observed frequency distribution with the corresponding values of a theoretical distribution. A Chi-Squared "goodness of fit" test can be determined with the following algorithm.

$$\chi^2 = \sum_{i=1}^K \left[\frac{(f_i - e_i)^2}{e_i} \right]$$

where

f_i = observed frequencies (samples) in the i th. bin of the Histogram,

e_i = expected frequencies (samples) in the i th. bin of the Histogram for a selected theoretical distribution,

K = total number of bins (cells) in the Histogram.

TEST RESULTS

Frequency

Four sets of ELINT parameter sampled data were collected for analysis. The frequency sampled data is presented in this section. Table 1 contains the summary of ELINT parameter analysis for frequency. The frequency data sets are labeled P1IFA, P1IFB, P1IF1, and P1IF2.

Appendix B contains a detailed analysis of the frequency sampled data for this radar with the data being measured by the RF Electronic Counter. The microwave downconverter was employed to convert the 9.24 GHz signal to approximately 410 MHz. The 410 MHz RF pulse signal was then measured by the Electronic Counter. As mentioned earlier, four independant sampled data sets were measured for the ELINT frequency parameter. One thousand data samples were collected for each of the four sets.

The radar did not have large peak to peak swings in frequency, hence, the RF Electronic Counter was setup to operate in the time averaging mode to improved resolution. The averaging time period was selected to be 100 microseconds which corresponds to a frequency resolution of 10 kilohertz. Shorter averaging time periods would be desirable but this frequency resolution was compatiable with the frequency variation associated with this emitter. The radar's pulselwidth was 0.2 microseconds, hence, approximately 500 pulses were time averaged by the Electronic Counter to obtain one sampled data.

Table One summarizes the results of the frequency sampled data analysis. The statistical parameters for each data set are listed

TABLE ONE
ELINT PARAMETER ANALYSIS - FREQUENCY

DATA STATISTICAL SET PARAMETER	P1IFA	P1IFB	P1IF1	P1IF2
MEAN VALUE (MHz)	410.92	410.96	410.20	410.07
MEDIUM VALUE (MHz)	410.77	410.68	410.10	409.93
DATA RANGE (MHz)	0.49	0.57	0.4	0.3
STANDARD DEVIATION (MHz)	0.0904	0.089	0.069	0.051
COEFFICIENT OF SKEWNESS	0.076	0.077	0.063	0.130
COEFFICIENT OF KURTOSIS	2.16	3.03	1.88	2.94
CHI-SQUARED	16.2(13c) 30.1(15c) 23.2(17c) 56.0(19c)	30.6(17c) 18.5(19c) 31.1(21c) 56.9(21c)	47.3(15c) 76.2(17c) 20.0(19c) 56.9(21c)	46.5(13c) 24.9(15c) 90.6(17c) 152.4(19c)
25 - 75 INTER-PERCENTILE RANGE MHz (approximate)	0.07(50%)	0.046(40%)	0.04(42%)	0.04(42%)

and parameters do vary from one data set to another. The standard deviation varies from 51 kilohertz to 90.4 kilohertz, but this is consistent with real world radar systems. The coefficient of skewness is very low for all data sets. The coefficient of kurtosis is a normalized measure of distribution peakness and the results are low.

Chi-squared "goodness of fit" tests were performed by comparing the observed frequency distribution with a given number of cells to the corresponding values of a theoretical Gaussian distribution. The Gaussian distribution was selected by visual analysis of the frequency histogram data. If the number of cells is selected empirically, then the Gaussian theoretical distribution will closely approximate the actual data. Thirteen cells would be chosen for data set P1IFA, nineteen cells for data set P1IFB, nineteen cells for data set P1IF1, and fifteen cells for data set P1IF2. (See minimum Chi-squared values in Table 1.)

Pulsewidth

Two sets of ELINT pulsewidth sampled data were collected for this analysis. The pulsewidth data sets are labelled P1PWA and P1PWB. Table 2 contains the summary of ELINT parameter analysis for pulsewidth. Appendix C contains the detailed test results for this ELINT parameter. One thousand data samples were collected for each of the two sets.

The mean value of the radar's pulsewidth is 219.94 nsecs, with a standard deviation of 0.094 nsec for P1PWA data set. Data set P1PWB produces a mean value of 219.43 nsecs, with a standard

deviation of 0.075 nsec.

The Coefficients of skewness and kurtosis are small for both data sets. Chi-squared tests were performed by comparing the observed pulselwidth distribution with a selected number of cells to the corresponding values of a theoretical Gaussian distribution.

Sixteen cells are chosen for P1PWA to minimize the chi-squared results. Ten cells are selected for P1PWB to minimize the Chi-squared result.

PRI

Two sets of ELINT PRI sampled data were collected for this analysis. The PRI data sets are labelled P1RRA and P1RRB. Table 3 contains the summary of ELINT parameter analysis for PRI. Appendix D contains the detailed test results for this ELINT parameter. One thousand non-averaged data samples were collected for each of the two sets.

The mean value of the radar's PRI is 499.529 microseconds, with a standard deviation of 0.0028 microseconds for P1RRA. Data set P1RRB produces a mean value of 499.507 microseconds, with a standard deviation of 0.0031 microseconds.

Coefficients of skewness and kurtosis are small for both data sets. Chi-squared tests were performed by comparing the observed PRI distribution with a selected number of cells to the corresponding values of a theoretical Gaussian distribution

Seven cells are chosen to minimize to chi-squared result for data sets P1RRA and P1RRB.

TABLE TWO
ELINT PARAMETER ANALYSIS - PULSEWIDTH

DATA STATISTICAL SET PARAMETER	P1PWA	P1PWB
MEAN VALUE (nsecs.)	219.94	219.43
MEDIAN VALUE (nsecs.)	219.85	219.37
DATA RANGE (nsecs)	0.48	0.41
STANDARD DEVIATION (nsecs)	0.094	0.075
COEFFICIENT OF SKEWNESS	0.04	0.54
COEFFICIENT OF KURTOSIS	2.14	2.86
CHI-SQUARED	96.5(15c) <u>69.3(16c)</u> 75.1(17c) 151.3(19c) 97.5(24c)	83.1(8c) <u>72.0(10c)</u> 101.3(13c) 121.0(15c) 102.2(19c)
25-75 INTER-PERCENTILE range-nsec (approx)	0.06(40%)	0.08(58%)

TABLE THREE
ELINT PARAMETER ANALYSIS - PRI

DATA STATISTICAL PARAMETER	P1RRA	P1RRB
MEAN VALUE (microsec)	449.529	499.507
DATA RANGE (microsec)	0.014	0.014
STANDARD DEVIATION (microsec)	0.0028	0.0031
COEFFICIENT OF SKEWNESS	0.04	-0.19
COEFFICIENT OF KURTOSIS	2.31	2.36
CHI-SQUARED	<u>26.0(7c)</u> 196.8(11c) 199.0(14c) 412.0(17c)	<u>28.0(7c)</u> 188.5(11c) 161.0(14c) 404.2(17c)
25-75 INTER-PERCENTILE RANGE-microsec (approx)	0.004(69%)	0.004(63%)

CONCLUSIONS

The following tasks have been completed during this development effort:

1. Data collection software for the RF Electronic Counter ELINT sensor has been completed. The software program is included in Appendix A.
2. Statistical analysis software has been written and debugged. The software programs are included in Appendix A.
3. Frequency, pulsewidth and PRI sampled data have been collected for the AN/PPS-6 radar.
4. Statistical analysis of the frequency, pulsewidth and PRI sampled data have been completed. Summary results are presented in the test results section of this report. Detailed statistical analysis results are presented in Appendix B, C and D of this report.

APPENDIX A

Computer software programs are listed in this appendix for data collection and data processing and analysis. Programs are as follows:

1. GETVAL Program - This program is used to collect data with the RF Electronic Counter sensor.
2. TPLOT Program - The data samples are plotted as a function of time.
3. HPLOT Program - The data collected using GETVAL program can be analyzed in histogram form with this program.
4. DATAS Program - This program is used to compute the statistical parameters associated with the data.
5. PRINTP Program - This program prints the statistical parameters derived from the DATAS Program.
6. HISTP Program - This program plots the theoretically expected histogram and the measured data histogram on one plot.

GETVAL

```
10 ! THIS PROGRAM GETS >.4 GHZ DATA FROM 5345 W/5355 PLUGIN
20 ! AT THIS POINT ITS HISTOGRAM CAN BE PLOTTED USING 'HPILOT'
25 PRINTER IS 704
30 DIM F(1001),A$(24)
40 DISP "ENTER NUMBER OF DATA POINTS <1000"
50 INPUT N@ D(0)=N
60 DISP "PRINT POINTS? Y/N"
70 INPUT D$
80 DISP "GHZ MHZ KHZ NS US? ENTER G,M,K,N, OR U"
90 INPUT S$
100 SETTIME 0,111
110 IF S$="G" THEN Scal=1000000000
120 IF S$="M" THEN Scal=1000000
125 IF S$="K" THEN Scal=1000
130 IF S$="N" THEN Scal=.000000001
140 IF S$="U" THEN Scal=.000001
150 Sum=0
160 FOR K=1 TO N
170 ENTER 718 ; F(K)
180 IF F(K)=0 THEN 170
190 F(K)=F(K)/Scal
200 Sum=Sum+F(K)
210 IF D$="N" THEN 230
220 PRINT K,F(K)
230 NEXT K
240 Mean=Sum/N
250 Sm2=0
260 FOR K=1 TO N
270 Sm2=(F(K)-Mean)^2+Sm2
280 NEXT K
290 V=Sm2/N
300 PRINT "VARIANCE=";V
310 PRINT TIME ";" SECONDS AQ"
320 BEEP 250,250
330 F(0)=N
340 PRINT "MEAN=";Mean
350 PRINT "NUMBER OF POINTS=";N
360 DISP "ENTER FILENAME TO STORE"
370 INPUT F$
380 CREATE F$,1,(N+1)*8+6
390 ASSIGN# 1 TO F$
400 F(0)=N
410 FOR K=0 TO N
420 PRINT# 1 ; F(K)
430 NEXT K
440 ASSIGN# 1 TO *
450 PRINT "FILENAME= ";F$
460 PRINT "" @ PRINT ""
470 BEEP 250,500 @ DISP "DONE"
480 END
```

T PLOT PROGRAM

```
10 ! T PLOT PLOTS RAW DATA VS TIME
20 DIM V(1001),A$(32),B$(32),C$(32),A]$(32)
30 DISP "ENTER DATA FILENAME"
40 INPUT FS
50 ASSIGN# 1 TO FS
60 READ# 1 ; V(0)
70 N=V(0)
80 FOR K=1 TO N
90 READ# 1 ; V(K)
100 NEXT K
110 ASSIGN# 1 TO *
120 F1=1000000000 @ F2=0 @ T=0
130 DJSP "GETING MAX MIN MEAN"
140 T=0
150 V1=0
160 FOR K=1 TO N ! GET MAXMIN MN
170 IF V(K)<F1 THEN F1=V(K)
180 IF V(K)>F2 THEN F2=V(K)
190 T=T+V(K)
200 V1=V(K)^2+V1
210 NEXT K
220 M=T/N @ DISP "MEAN=";M
230 V=V1/N-M^2
240 BFFP 250,250
250 DISP "FMAX=";F2
260 DJSP "FMIN=";F1
270 DISP "YAXIS MHZ KHZ USEC OR NSEC? ENTER M K U OR N"
280 INPUT Quan$
290 Q1=1
300 X1=0 @ X2=Q1
310 Y1=F1-.1 @ Y2=F2+.1
320 R1=X2-X1
330 ! START PLOT
340 PLOTTER IS 705
350 PEN 1
360 LOCATE 30,110,32,89
370 X3=X1 @ Y3=Y1
380 Y4=(Y2-Y1)/10 @ X4=(X2-X1)/10
390 SCALE X1,X2,Y1,Y2
400 ! DRAW AXES
410 XAXIS Y3,X4,X3,X2
420 YAXIS X3,Y4,Y1,Y2
430 MOVE X1-R1/50,Y1-(Y2-Y1)/20
440 LABEL X1
450 MOVE X2-R1/50,Y1-(Y2-Y1)/20
460 LABEL X2
470 FOR K=1 TO N
480 PLOT Q1*K/N,V(K)
490 NEXT K
```

500 PEN UP ! PUT LABELS
510 PLOT (X1+X2)/2,Y2+4*(Y2-Y1)/8
520 B\$="RELATIVE TIME"
530 IF Quan\$="M" THEN C\$="FREQUENCY IN MHZ"
540 IF Quan\$="U" THEN C\$="TIME IN MICROSECONDS"
550 IF Quan\$="K" THEN C\$="FREQUENCY IN KILOHERTZ"
560 IF Quan\$="N" THEN C\$="TIME IN NANoseconds"
570 A\$="HISTOGRAM TIME PLOT"
580 DISP F\$
590 DISP "ENTER TITLE"
600 INPUT A1\$
610 PEN UP
620 PLOT (X1+X2)/2,Y2+(Y2-Y1)/8
630 PEN UP
640 LORG 6
650 CSIZE 4
660 LABEL A\$
670 LABEL A1\$;" ";F\$
680 PLOT (X1+X2)/2,Y1-(Y2-Y1)/8,-2
690 LORG 4
700 LABEL B\$
710 DEG
720 LDIR 90
730 LORG 6
740 LORG 5
750 PLOT X1-(X2-X1)/8,(Y1+Y2)/2,-2
760 LABEL C\$
770 LDIR 0
780 MOVE X1-R1/10,Y2
790 LABEL Y2
800 MOVE X1-R1/10,Y1
810 LABEL Y1
820 LDIR 0
830 DISP "RE-DRAW? Y/N"
840 INPUT Z\$
850 IF Z\$="Y" THEN 330
860 PEN 0
870 END

H PLOT PROGRAM

```
10 ! H PLOT THIS PROGRAM CALCULATES A HISTOGRAM FOR DATA FROM GETVAL.
20 DIM X(101),Y(101)
30 FOR K=0 TO 100 ! INITIALIZE X ARRAY
40 X(K)=0 @ Y(K)=0
50 NEXT K
60 DIM V(1001),AS[32],BS[32],CS[32],A1S[32]
70 E$="0" @ Z$="A"
80 DISP "ENTER DATA FILENAME"
90 INPUT FS
100 ASSIGN# 1 TO FS
110 READ# 1 ; V(0)
120 N=V(0)
130 FOR K=1 TO N
140 READ# 1 ; V(K)
150 NEXT K
160 ASSIGN# 1 TO *
170 F1=10000000000 @ F2=0 @ T=0
180 DISP "GETTING MAX MIN MEAN"
190 T=0
200 V1=0
210 FOR K=1 TO N ! GET MAXMIN MN
220 IF V(K)<F1 THEN F1=V(K)
230 IF V(K)>F2 THEN F2=V(K)
240 T=T+V(K)
250 NEXT K
260 M=T/N @ DISP "MEAN=";M
270 BEEP 250,250
280 DISP "MAX=";F2
290 DISP "MIN=";F1
300 DIM R(109),O(101)
310 IF E$="Y" THEN 380
320 DISP "ENTER PLOT TITLE"
330 INPUT A1$
340 DISP "ENTER XAXIS LABEL"
350 INPUT BS
360 X2=F2 @ X1=F1
370 R=F2-F1 @ R1=X2-X1
380 DISP "NUMBER OF CELLS ODD NUMBER <98"
390 INPUT N1
400 IF E$="Y" THEN 410
410 DISP "DEFINING CELLS"
420 FOR K=0 TO N1 ! DEFINE CELLS
430 R(K)=F1+R*K/N
440 NEXT K
450 C=R/N1
460 DISP "FILLING CELLS"
470 FOR K=0 TO N1-1
480 O(K)=0
```

```

490 NEXT K
500 Cpop=0
510 FOR J=0 TO N1-1 : PLOT (0,0,0)
520 FOR K=1 TO N1 : CHECK AJ, VAJ
530 IF I#N1-1 THEN 560
540 IF V(K)>= R(I) AND V(K)<= R(I+1) THEN O(I)=O(I)+1
550 GOTO 590
560 IF V(K)>= R(I) AND V(K)<R(I+1) THEN O(I)=O(I)+1
570 Cpop=Cpop+O(I)
580 IF Cpop=N/2 THEN Median=V(K)
590 NEXT K
600 DISP I.
610 NEXT I.
620 DISP "MEDIAN=";Median
630 DISP "GETTING MAX CELL SIZE"
640 M1=0 @ Tot=0
650 FOR K=0 TO N1-1
660 Tot=O(K)+Tot
670 IF O(K)>M1 THEN M1=O(K)
680 NEXT K
690 DISP "CELL MAX=";M1,"TOTAL POINTS=";Tot
700 Y1=0 @ Y2=M1
710 ! START PLOT
720 PLOTTER IS 705
730 PEN 1
740 LOCATE 30,110,32,89
750 X3=X1 @ Y3=Y1
760 Y4=(Y2-Y1)/10 @ X4=R/10
770 SCALE X1,X2,Y1,Y2
780 Y4=(Y2-Y1)/10 @ X4=R1/10
790 ! DRAW AXES
800 XAXIS Y3,X4,X1,X2
810 YAXIS X3,Y4,Y1,Y2
820 MOVE X1-R1/20,-((Y2-Y1)/30)
830 LABEL X1
840 MOVE X2-R1/20,-((Y2-Y1)/30)
850 LABEL X2
860 FOR K=0 TO N1-1
870 PLOT R(K),0
880 PLOT R(K),O(K)
890 PLOT R(K+1),O(K)
900 PLOT R(K+1),0
910 NEXT K
920 PEN UP
930 X(0)=N1 @ Y(0)=N1
940 FOR K=1 TO N1
950 X(K)=(R(K-1)+R(K))/2 @ Y(K)=O(K-1)
960 NEXT K
970 PEN UP
980 LINE TYPE 4 @ PLOT X1,.67*M1
990 PLOT X2,.66*M1

```

```

1000 PFN UP ! PUT LABELS
1010 PILOT (X1+X2)/2,Y2+4*(Y2-Y1)/8
1020 CS="NUMBER OF SAMPLES"
1030 AS="HISTOGRAM FOR "
1040 DS=" SAMPLES"
1050 DISP FS
1060 PEN UP
1070 PILOT (X1+X2)/2,Y2+(Y2-Y1)/8
1080 PEN UP
1090 LORG 6
1100 CSIZE 4
1110 LAPPF A$;N;DS
1120 LABEL A1$;" ";FS
1130 PILOT (X1+X2)/2,Y1-(Y2-Y1)/8,-2
1140 LORG 4
1150 LAPPF B$ 
1160 DEG
1170 LDIP 90
1180 LORG 6
1190 LORG 5
1200 PILOT X1-(X2-X1)/8,(Y1+Y2)/2,-2
1210 LABEL CS
1220 LDIR 0
1230 MOVE X1-R1/15,Y2
1240 LABEL M1
1250 PEN 2
1260 LDJR 0
1270 LORG 4 @ CSIZE 2.5
1280 PILOT X2-R1/10,Y2-(Y2-Y1)/20
1290 LABEL "# CELLS=";N1
1300 LAPPF "CELL. WIDTH=";C
1310 LAPPF "TOTAL CELL MEMBERS=";Tot
1320 LABEL "MAX=";F2
1330 LAPPF "MIN=";F1
1340 LABEL "DATA RANGE=";R]
1350 PEN 2
1360 PILOT M,Y1+(Y2-Y1)/15
1370 PILOT M,Y1-(Y2-Y1)/15
1380 PEN UP
1390 MOVE M-R/20,Y1-(Y2-Y1)/25
1400 LABEL "MEAN=";M
1410 FEN 1]
1420 X(0)=N1 @ Y(0)=F1 @ Y(99)=R] @ X(98)=Median @ Y(98)=Tot
1430 DISP "STORE DATA? Y/N"
1440 INPUT AS
1450 IF AS="N" THEN 1520
1460 DISP "ENTER FILENAME TO STORE"
1470 INPUT F1$
1480 CREATE F1$,1,1616+16
1490 ASSIGN# 1 TO F1$
1500 PRINT# 1 ; X(),Y()

```

```
1510 ASSIGN# 1 TO *
1520 DJSP "RE-DRAW? Y/N"
1530 INPUT Z$
1540 IF Z$="Y" THEN 700
1550 PEN 0
1560 DJSP "SAME DATA MORE CELLS? Y/N"
1570 INPUT E$
1580 IF E$="Y" THEN 300
1590 END
```

DATA'S PROGRAM

```
10 ! DATA'S THIS PROGRAM CALCULATES MEAN, VARIANCE AND STANDARD
20 ! DEVIATION FOR DATA SETS FROM GETVAL. DATA FROM HISTX IS THEN
30 ! READ IN, AND EXPECTED VALUES FOR EACH CELL ARE GENERATED
40 ! THRU PROBABILITY DENSITY FUNCTIONS. RESULTING ACTUAL AND EXPECTED
50 ! VALUES ARE THEN STORED ALONG WITH CELL CENTER VALUES FOR LATER
60 ! PLOTTING.
70 DJM V(1001),A$(32),B$(32),C$(32),A1$(32),X(101),Y(101),Px(101),E(101)
80 DJM Chj(101)
90 FOR K=0 TO 100
100 X(K)=0 @ Y(K)=0 @ E(K)=0
110 NEXT K
120 DISP "ENTER RAW DATA FILENAME"
130 INPUT FS
140 ASSIGN# 1 TO F$
150 READ# 1 ; V(0)
160 N=V(0)
170 FOR K=1 TO N
180 READ# 1 ; V(K)
190 NEXT K
200 ASSIGN# 1 TO *
210 F1=1000000000 @ F2=0 @ T=0
220 DJSP "GETTING MAX MIN MEAN"
230 T=0
240 VJ=0
250 BEEP 250,250
260 FOR K=1 TO N ! GET MAXMIN MN
270 IF V(K)<F1 THEN F1=V(K)
280 IF V(K)>F2 THEN F2=V(K)
290 T=T+V(K)
300 NFXT K
310 DISP "MIN=";F1,"MAX=";F2
320 N=T/N @ DISP "MEAN=";M
330 DJSP "CALCULATING CENTRAL MOMENTS"
340 SumS=0 @ Sum3=0 @ Sum4=0
350 FOR K=1 TO N
360 SumS=(V(K)-M)^2+SumS
370 Sum3=(V(K)-M)^3+Sum3
380 Sum4=(V(K)-M)^4+Sum4
390 NEXT K
400 V=SumS/N @ DISP "VARIANCE=";V
410 Cm3=Sum3/N @ Cm4=Sum4/N
420 Skew=Cm3/V^1.5
430 Kurt=Cm4/V^2
440 Sigma=SQR (V) @ DISP "STANDARD DEVIATION=";Sigma
450 BEEP 175,150
460 DISP "ENTER CH1 DATA FILENAME"
```

```
470 INPUT F1$  
480 ASSIGN# 1 TO F1$  
490 READ# 1 ; X(),Y()  
500 N1=X(0)  
510 Median=Y(0)  
  
520 Sume=0  
530 FOR K=1 TO N1  
540 Fx(K)=1/(SQR (2*PI)*Sigma)*EXP (-(.5*((X(K)-N1)/Sigma)^2))  
550 E(K)=Fx(K)*N*(F2-F1)/N1  
560 Sume=Sume+E(K)  
570 NEXT K  
580 DISP "TOTAL E(i) =";Sume  
590 Sumdif=0  
600 FOR K=1 TO N1  
610 Chj(K)=(Y(K)-E(K))^2/E(K)  
620 Sumdif=Sumdif+Chj(K)  
630 NEXT K  
640 X(0)=N1 @ Y(0)=F1 @ E(0)=F2 @ Y(99)=F2-F1 @ F(99)=Y(99)/N1 @ X(98)=Median  
650 X(100)=Sigma @ Y(100)=Skew @ E(100)=Kurt @ X(99)=Sumdif  
660 E(98)=M  
670 DISP "ENTER FILENAME TO STORE"  
680 INPUT F2$  
690 CREATE F2$,1,303*8+25  
700 ASSIGN# 1 TO F2$  
710 PRINT# 1 ; X(),Y(),E()  
720 ASSIGN# 1 TO *  
730 BEEP 250,200 @ DISP "DONE"  
740 END
```

PRINTP PROGRAM

```
10 ! PRINTP THIS PROGRAM PRINTS DATA DERIVED FROM DATAS
20 DIM X(101),Y(101),E(101)
30 PRINTER IS 704
40 DISP "FILE FROM DATAS?"
50 INPUT FS
60 ASSIGN# 1 TO FS
70 READ# 1 ; X(),Y(),E()
80 PRINT "                                     FILE ";FS
90 PRINT
100 FXD 3
110 IMAGE 10X,"MIN=",DDD.DD,17X,"MAX=",DDD.DD
120 N1=X(0) @ Xmin=Y(0) @ Xmax=E(0)
130 Sigma=X(100) @ Skew=Y(100) @ Kurt=E(100) @ Chi=X(99)
140 PRINT USING 110 ; Xmin,Xmax
150 PRINT
160 IMAGE 10X,"CFIL. #",2X,"CENTER",3X,"# SAMPLES",3X,"EXPECTED"
170 IMAGE 11X,DD,5X,DDD.DD,5X,DDD,8X,DDD.DDD
180 PRINT USING 160
190 Sume=0 @ Sumy=0
200 FOR K=1 TO N1
210 PRINT USING 170 ; K,X(K),Y(K),E(K)
220 Sume=Sume+E(K)
230 Sumy=Sumy+Y(K)
240 NEXT K
250 PRINT "      ;" "STANDARD DEVIATION=";X(100)
260 PRINT "      ;" "COEFF OF SKEWNESS=";Y(100)
270 PRINT "      ;" "COEFF OF KURTOSIS=";E(100)
280 PRINT "      ;" "CHI-SQUARED=";X(99)
290 PRINT "      ;" "MEDIAN X VALUE=";X(98)
300 PRINT "      ;" "CFIL WIDTH=";E(99)
310 PRINT "      ;" "DATA RANGE=";Y(99)
320 PRINT "      ;" "SUM ACTUAL=";Sumy
330 PRINT "      ;" "SUM EXPECTED=";Sume
340 PRINT CHR$(12)
350 BEEP 250,200 @ DISP "DONE"
360 END
```

HISTP PROGRAM

```
10 ! HISTP THIS PROGRAM TAKES INPUTTED VALUES AND MEASURED VALUES
20 ! FROM DATA DERIVED FROM DATA'S VERSUS CDR. COUNT VALUES
30 DIM X(101),Y(101),E(101)
40 FOR K=0 TO 101 ! INITIALIZE ALL ARRAYS
50 X(K)=0 @ Y(K)=0 @ E(K)=0
60 NEXT K
70 DIM A$(32),B$(32),C$(32),A1$(32)
80 E$="0" @ Z$="A"
90 DISP "ENTER DATA FILENAME"
100 INPUT F$
110 ASSIGN# 1 TO F$
120 READ# 1 ; X(),Y(),E()
130 ASS# 1 "0 "
140 N1=X(0) @ Xmin=Y(0) @ Xmax=E(0)
150 Ymax=0
160 FOR K=1 TO N1 ! GET YMAX
170 IF Y(K)>Ymax THEN Ymax=Y(K)
180 NEXT K
190 Ymax=Ymax+5
200 DISP "ENTER PLOT TITLE"
210 INPUT A1$
220 DISP "ENTER XAXIS LABEL"
230 INPUT B$
240 X2=Xmax @ X1=Xmin
250 Y2=Ymax @ R1=X2-X1
260 Y1=0
270 ! START PLOT
280 PLOTTER IS 705
290 PEN 1
300 LOCATE 30,110,32,89
310 X3=X1 @ Y3=Y1
320 Y4=(Y2-Y1)/10 @ X4=(X2-X1)/10
330 R1=X2-X1
340 SCALE X1,X2,Y1,Y2
350 ! DRAW AXES
360 XAXIS Y3,X4,X1,X2
370 YAXIS X3,Y4,Y1,Y2
380 MOVE X1-R1/20,-((Y2-Y1))/30
390 LABEL X1
400 MOVE X2-R1/20,-((Y2-Y1))/30
410 LABEL X2
420 FOR K=1 TO N1
430 PLOT X(K),Y(K)
440 NEXT K
450 PEN UP
```

```

460 FOR K=1 TO N1
470 MOVE X(K),Y(K)
480 LORG 5
490 LABEL "X"
500 NEXT K

510 PEN UP
520 PEN UP ! PUT LABF1.S
530 PLOT (X1+X2)/2,Y2+4*(Y2-Y1)/8
540 C$="NUMBFR OF SAMPLES"
550 A$="PROBABILITY FOR"
560 B$=" CELLS"
570 DISP F$
580 PEN UP
590 PLOT (X1+X2)/2,Y2+(Y2-Y1)/8
600 PEN UP
610 LORG 6
620 CSIZE 4
630 LABEL A$;N1;D$
640 LABEL A1$;" ";F$
650 PLOT (X1+X2)/2,Y1-(Y2-Y1)/8,-2
660 LORG 4
670 LABEL B$
680 DEG
690 LDIR 90
700 LORG 6
710 LORG 5
720 PLOT X1-(X2-X1)/8,(Y1+Y2)/2,-2
730 LABEL C$
740 MOVE Xmin,Ymax
750 LDIR 0
760 LORG 8
770 LABEL Ymax
780 PEN 2 @ LDIR 0
790 LORG 4 @ CSIZE 2.5
800 MOVE X2-R1/10,Y2-(Y2-Y1)/20
810 LABEL "MEAN VALUE=";E(98)
820 LABEL "MEDIAN VALUE=";X(98)
830 LABEL "SKEW=";Y(100)
840 LABEL "KURTOSIS=";E(100)
850 LABEL "CHI-SQUARED=";X(99)
860 DISP "RE-DRAW? Y/N"
870 INPUT Z$
880 IF Z$="Y" THEN 270
890 PEN 0
900 BEEP 175,50 @ WAIT 950 @ BEEP 175,50 @ WAIT 950 @ BEEP 175,50 @ BEEP
910 END

```

APPENDIX B

Introduction

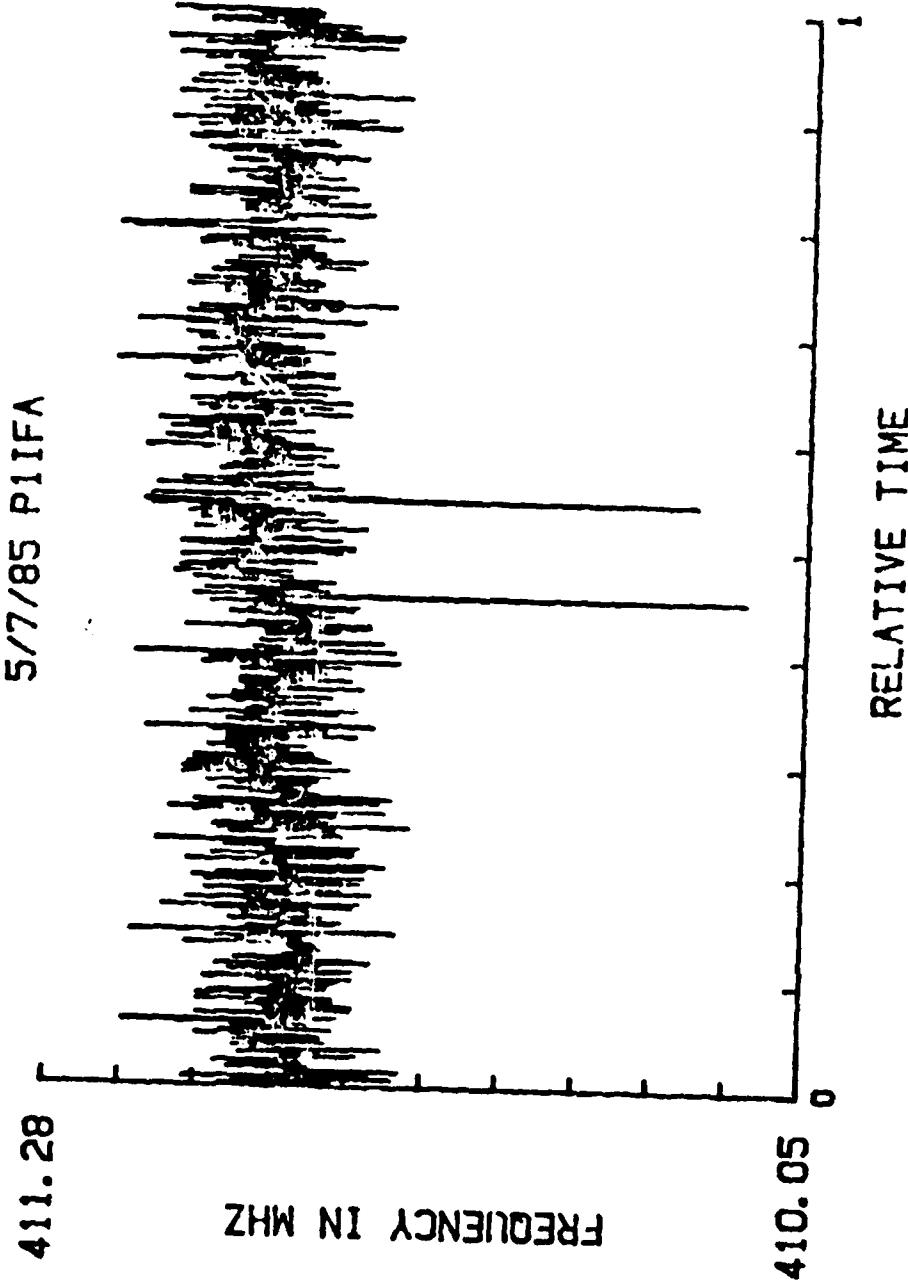
ELINT parameter test results are contained in this appendix for the ELINT frequency parameter associated with the AN/PPS-6 radar. Four sets of the frequency sampled data were collected and the analyzed results are presented in this appendix. The frequency data sets are labelled PIIF_A, PIIF_B, PIIF₁, PIIF₂.

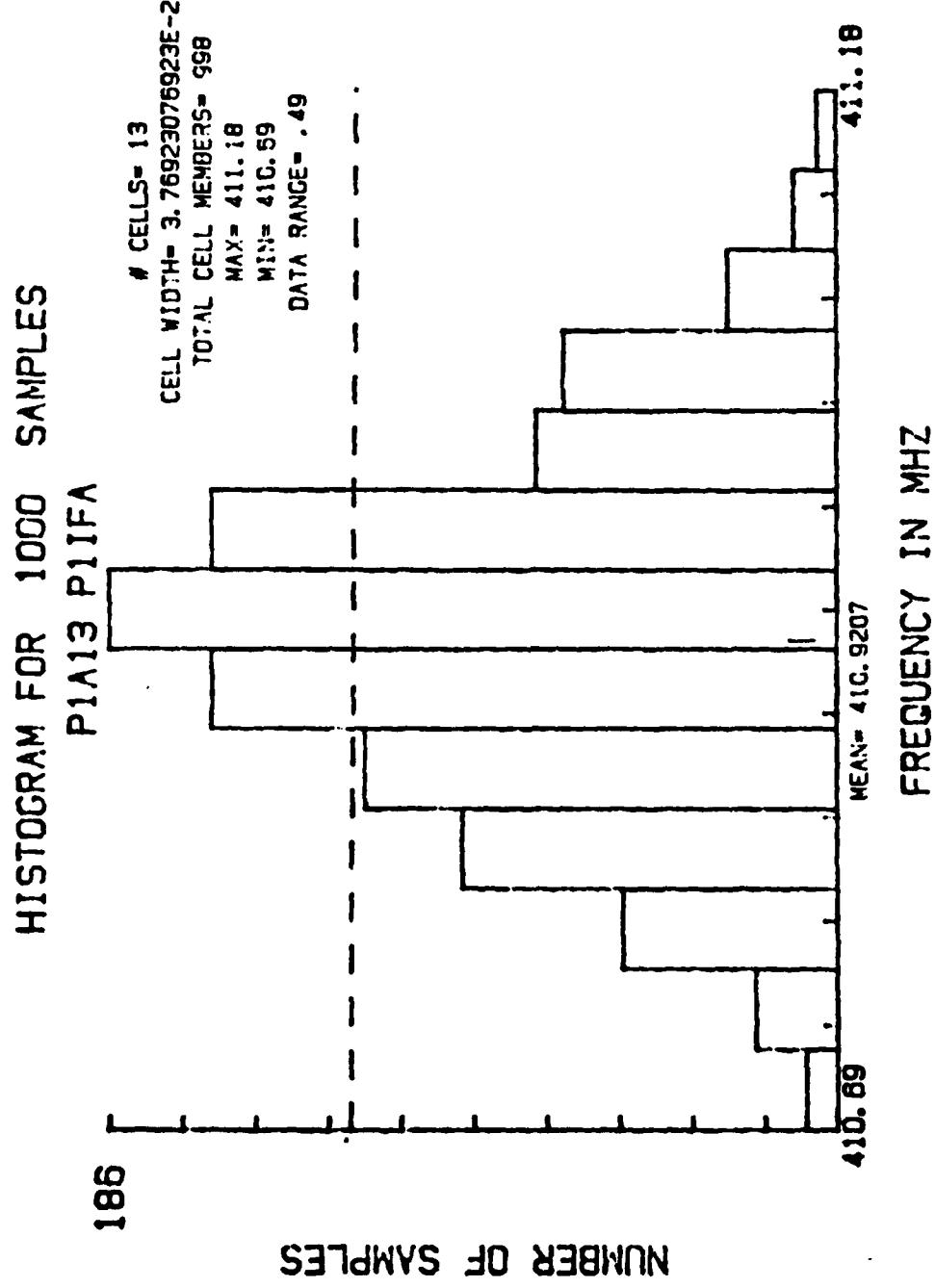
Frequency Sampled Data - PIIFA

The statistical results of frequency sampled data PIIFA are presented on the next 13 pages. Histogram time plot, histograms with selected number of cells, and statistical analysis are presented.

The test results section of this report contains summary statistical information associated with this frequency data set.

HISTOGRAM TIME PLOT
5/7/85 P11FA





PROBABILITY FOR 13 CELLS

PIA13

MEAN VALUE= 0
MEDIAN VALUE= 410.77
SKEW=-.991124434352
KURTOSIS= 10.8642343082
CHI-SQUARED= 16.2413762573

NUMBER OF SAMPLES

411.18
410.69

FREQUENCY IN MHZ

FILE PLA13

MIN=410.69

MAX=411.18

CELL #	CENTER	# SAMPLES	EXPECTED
1	410.71	8	10.661
2	410.75	21	25.980
3	410.78	55	53.205
4	410.82	96	91.561
5	410.86	121	132.411
6	410.90	160	160.911
7	410.94	186	164.322
8	410.97	160	141.013
9	411.01	77	101.689
10	411.05	70	61.622
11	411.09	28	31.380
12	411.12	11	13.428
13	411.16	5	4.829

STANDARD DEVIATION= .0904

COEFF OF SKEWNESS= -.9911

COEFF OF KURTOSIS= 10.8642

CHI-SQUARED= 16.2414

MEDIAN X VALUE= 410.7700

CELL WIDTH= .037692

DATA RANGE= .490

SUM ACTUAL= 998

SUM EXPECTED= 993.0105

HISTOGRAM FOR 1000 SAMPLES

P1A15 P11FA

186

NUMBER OF SAMPLES

CELLS= 15

CELL WIDTH= 3.25666666666667E-2

TOTAL CELL MEMBERS= 998

MAX= 411.18

MIN= 410.69

DATA RANGE= .49

MEAN= 410.9207

411.18

410.69

FREQUENCY IN MHZ

PROBABILITY FOR 15 CELLS

P1A15

191

NUMBER OF SAMPLES

MEAN VALUE= 0
MEDIAN VALUE= 410.77
SKEW=-.991124434352
KURTOSIS= 10.8642343082
CHI-SQUARED= 30.0934377951

411.18

FREQUENCY IN MHZ

410.69

FILE PLATS

MIN=410.69

MAX=411.18

CELL #	CENTER	# SAMPLES	EXPECTED
1	410.71	8	8.653
2	410.74	17	19.106
3	410.77	30	37.019
4	410.80	67	62.942
5	410.84	101	93.910
6	410.87	109	122.953
7	410.90	129	141.259
8	410.94	186	142.413
9	410.97	128	125.990
10	411.00	84	97.808
11	411.03	60	66.630
12	411.07	54	39.831
13	411.10	13	20.894
14	411.13	7	9.618
15	411.16	5	3.885

STANDARD DEVIATION=.0904
COEFF OF SKEWNESS=-.9911
COEFF OF KURTOSIS=10.8642
CHI-SQUARED=30.0934
MEDIAN X VALUE=410.7700
CELL WIDTH=.032667
DATA RANGE=.490
SUM ACTUAL=998
SUM EXPECTED=992.9100

HISTOGRAM FOR 1000 SAMPLES

P1A17 P11FA

134

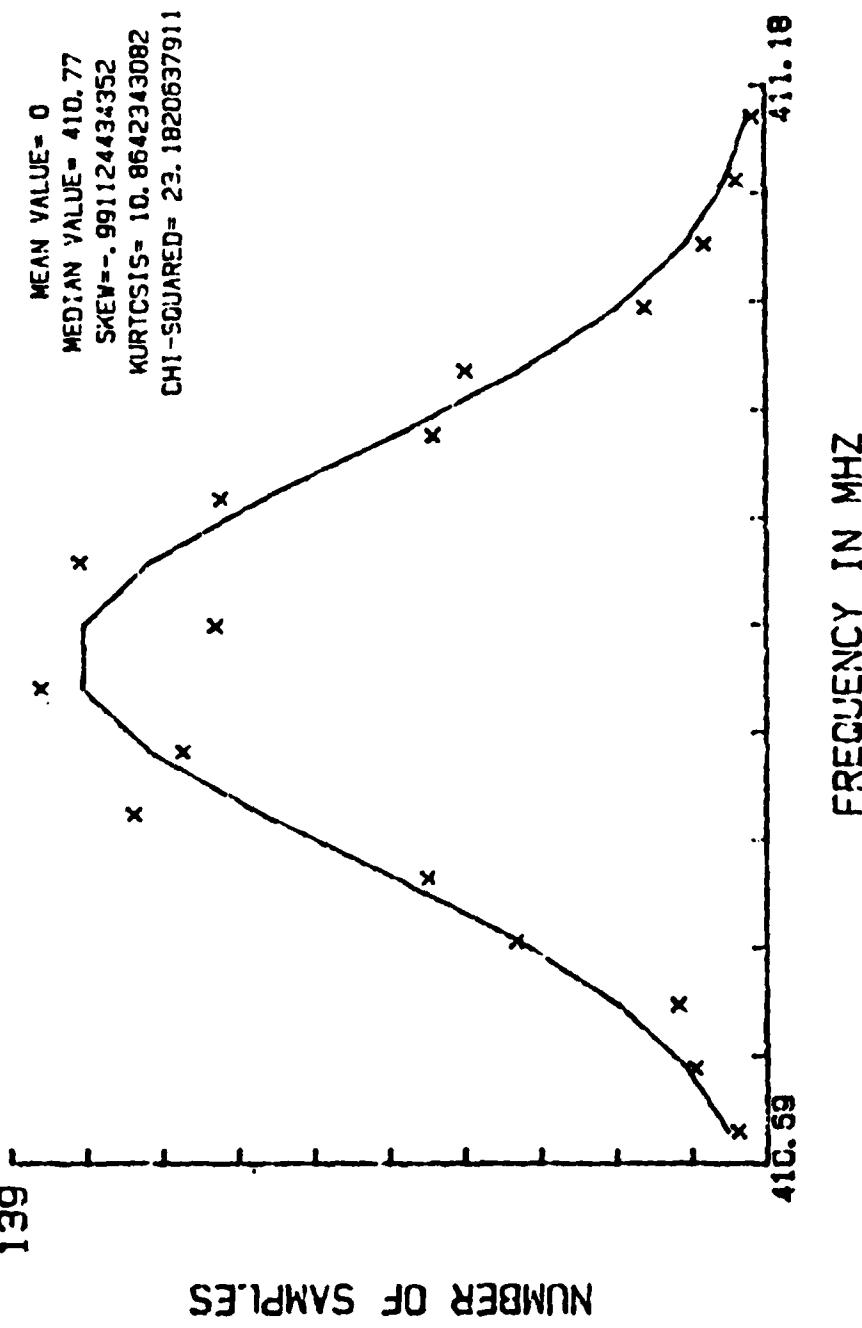
NUMBER OF SAMPLES

CELLS= 17
CELL WIDTH= 2.88235294118E-2
TOTAL CELL MEMBERS= 998
MAX= 411.18
MIN= 410.69
DATA RANGE= .49

411.18
410.9207
410.69

FREQUENCY IN MHZ

PROBABILITY FOR 17 CELLS
5/7/85 P1A17



FILE P1A17

MIN=410.69

MAX=411.18

CELL #	CENTER	# SAMPLES	EXPECTED
1	410.70	6	7.258
2	410.73	14	14.799
3	410.76	17	27.257
4	410.79	47	45.346
5	410.82	63	68.144
6	410.85	117	92.499
7	410.88	108	113.415
8	410.91	134	125.609
9	410.94	102	125.658
10	410.96	127	113.549
11	410.99	101	92.682
12	411.02	62	68.333
13	411.05	56	45.507
14	411.08	23	27.375
15	411.11	12	14.875
16	411.14	6	7.301
17	411.17	3	3.237

STANDARD DEVIATION=.0904

COEFF OF SKEWNESS=-.9911

COEFF OF KURTOSIS=10.8642

CHI-SQUARED=23.1821

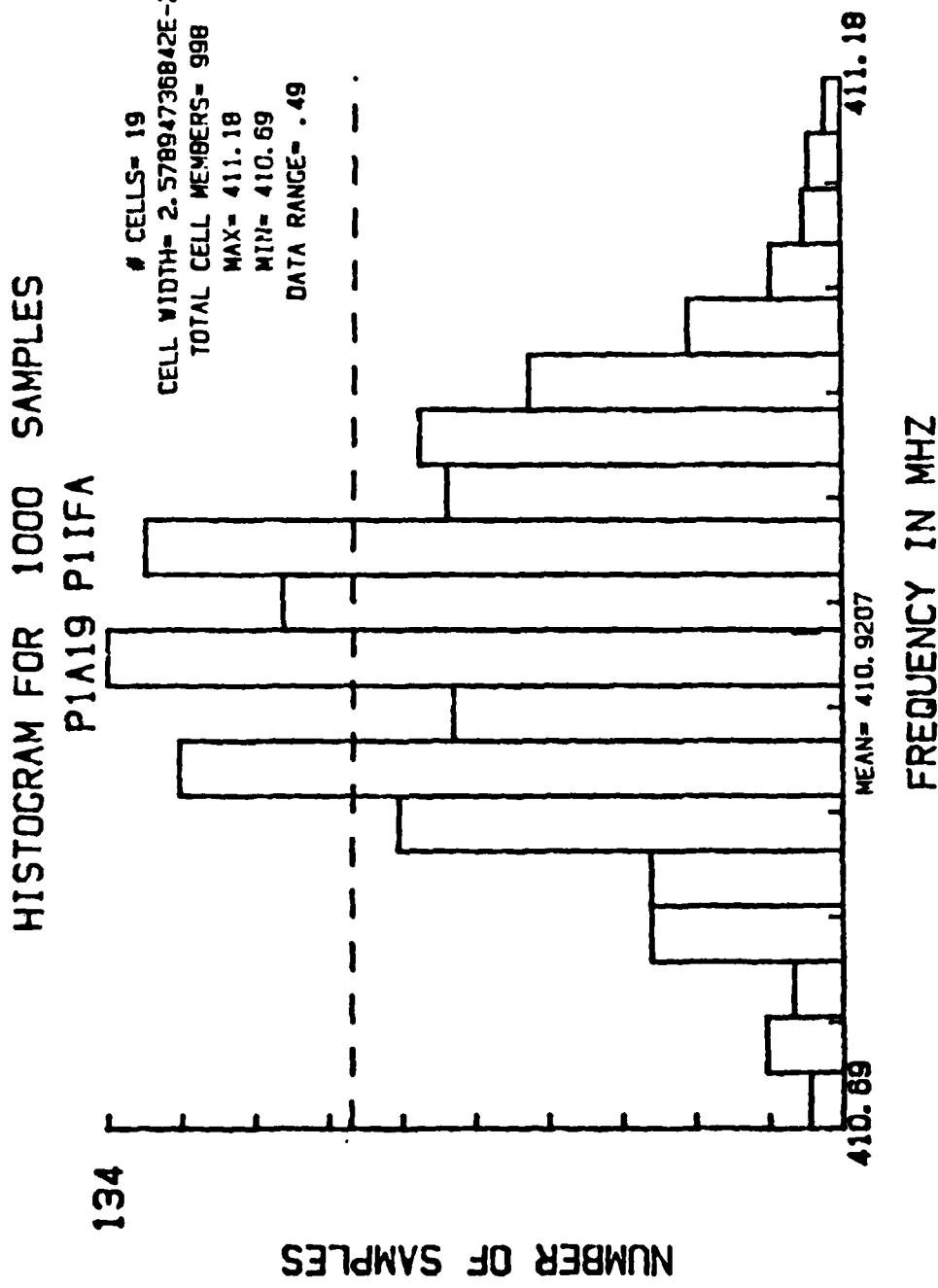
MEDIAN X VALUE=410.7700

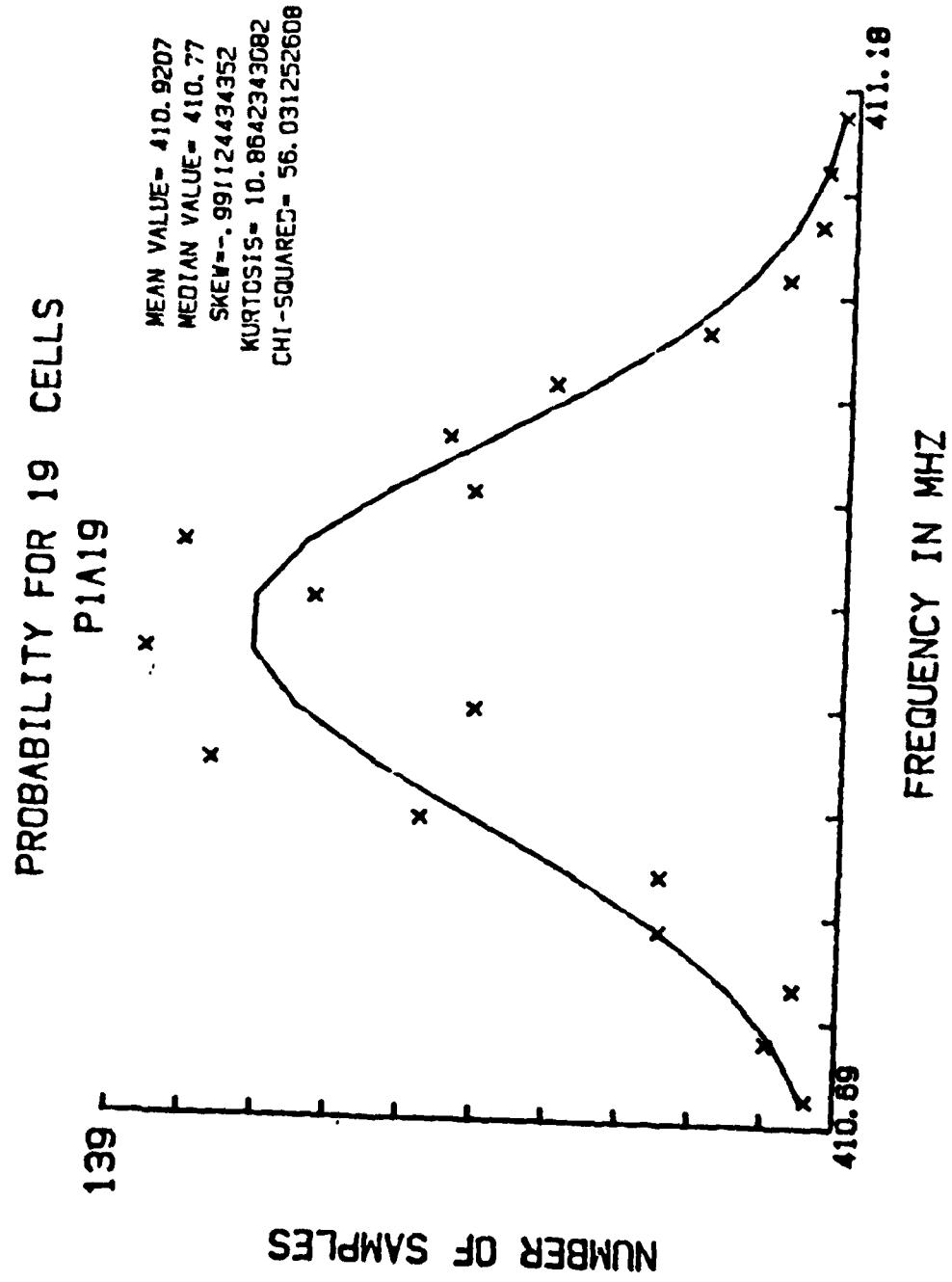
CELL WIDTH=.028824

DATA RANGE=.490

SUM ACTUAL=998

SUM EXPECTED=992.8422





FILE PLA19

MIN=410.69

MAX=411.18

CELL #	CENTER	# SAMPLES	EXPECTED
1	410.70	6	6.237
2	410.73	14	11.912
3	410.75	9	20.972
4	410.78	35	34.035
5	410.81	35	50.915
6	410.83	81	70.208
7	410.86	121	89.241
8	410.88	71	104.562
9	410.91	134	112.931
10	410.94	102	112.431
11	410.96	127	103.179
12	410.99	72	87.283
13	411.01	77	68.061
14	411.04	57	48.921
15	411.06	28	32.414
16	411.09	13	19.797
17	411.12	7	11.145
18	411.14	6	5.784
19	411.17	3	2.767

STANDARD DEVIATION=.0904

COEFF OF SKEWNESS= -.9911

COEFF OF KURTOSIS= 10.8642

CHI-SQUARED= 56.0313

MEDIAN X VALUE= 410.7700

CELL WIDTH=.025789

DATA RANGE=.490

SUM ACTUAL= 998

SUM EXPECTED= 992.7944

Frequency Sampled Data - P1IFB

The statistical results of frequency sampled data P1IFB are presented on the following 10 pages. Histogram time plot, histograms with selected number of cells, and statistical analysis are presented. The TEST RESULTS SECTION of this report contains summary statistical information associated with this frequency data set.

HISTOGRAM TIME PLOT
P1IFB

411.35

FREQUENCY IN MHz

410.58

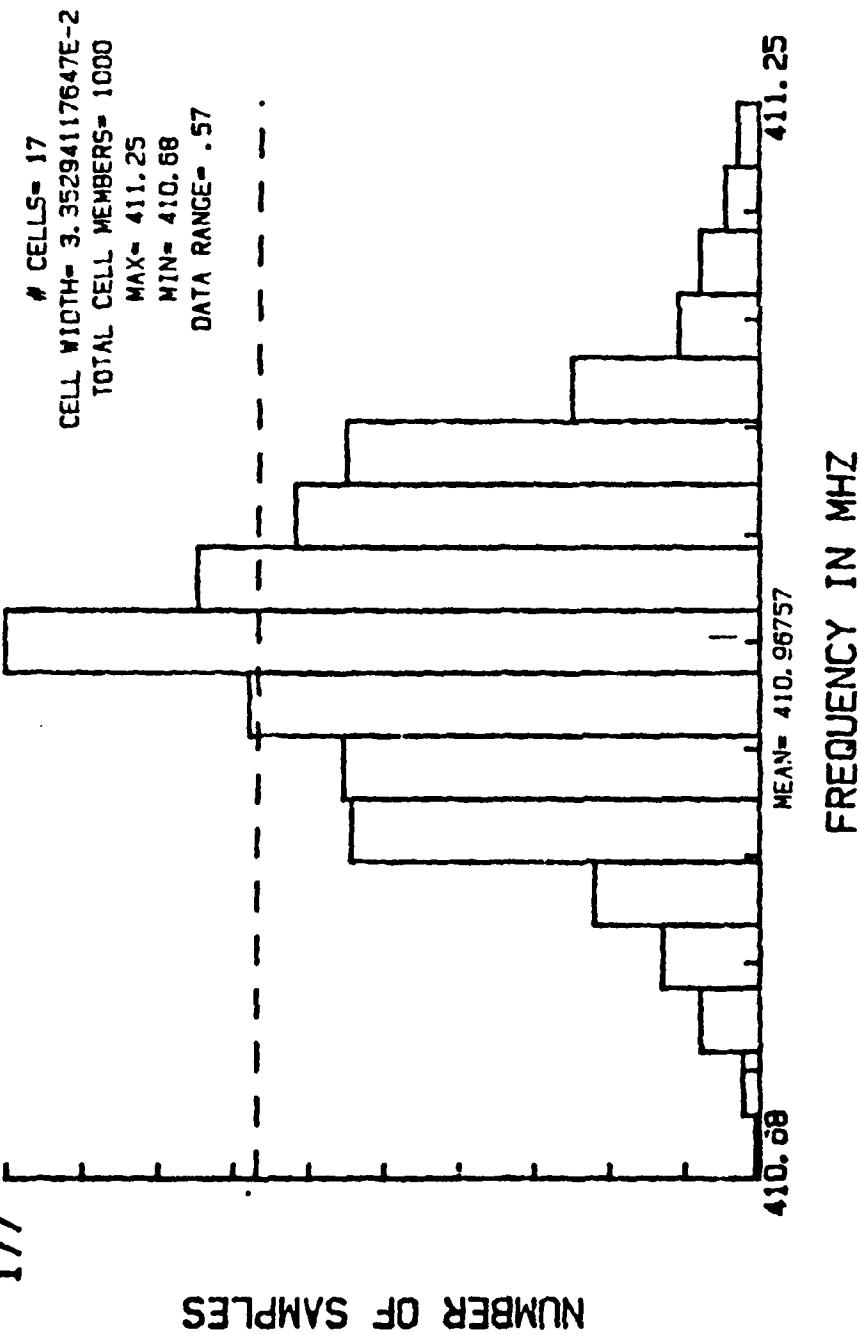
TIME IN SECONDS

500

HISTOGRAM FOR 1000 SAMPLES

P1B17 P1IFB

177



PROBABILITY FOR 17 CELLS

P1B17X

MEAN VALUE= 410.96757
MEDIAN VALUE= 410.68
SKEW= 7.67818870114E-2
KURTOSIS= 3.02953561356
CHI-SQUARED= 30.5583582568

182

NUMBER OF SAMPLES

FREQUENCY IN MHZ

411.25

FILE P1B17X

MIN=410.68

MAX=411.25

CELL #	CENTER	# SAMPLES	EXPECTED
1	410.70	1	1.476
2	410.73	4	4.319
3	410.76	14	10.970
4	410.80	23	24.180
5	410.83	39	46.255
6	410.86	96	76.792
7	410.90	98	110.642
8	410.93	120	138.347
9	410.97	177	150.129
10	411.00	132	141.386
11	411.03	109	115.556
12	411.07	97	81.965
13	411.10	44	50.455
14	411.13	19	26.955
15	411.17	14	12.497
16	411.20	8	5.028
17	411.23	5	1.756

STANDARD DEVIATION= 8.90617488038E-2

COEFF OF SKEWNESS= 7.67818870114E-2

COEFF OF KURTOSIS= 3.02953561356

CHI-SQUARED= 30.5583582566

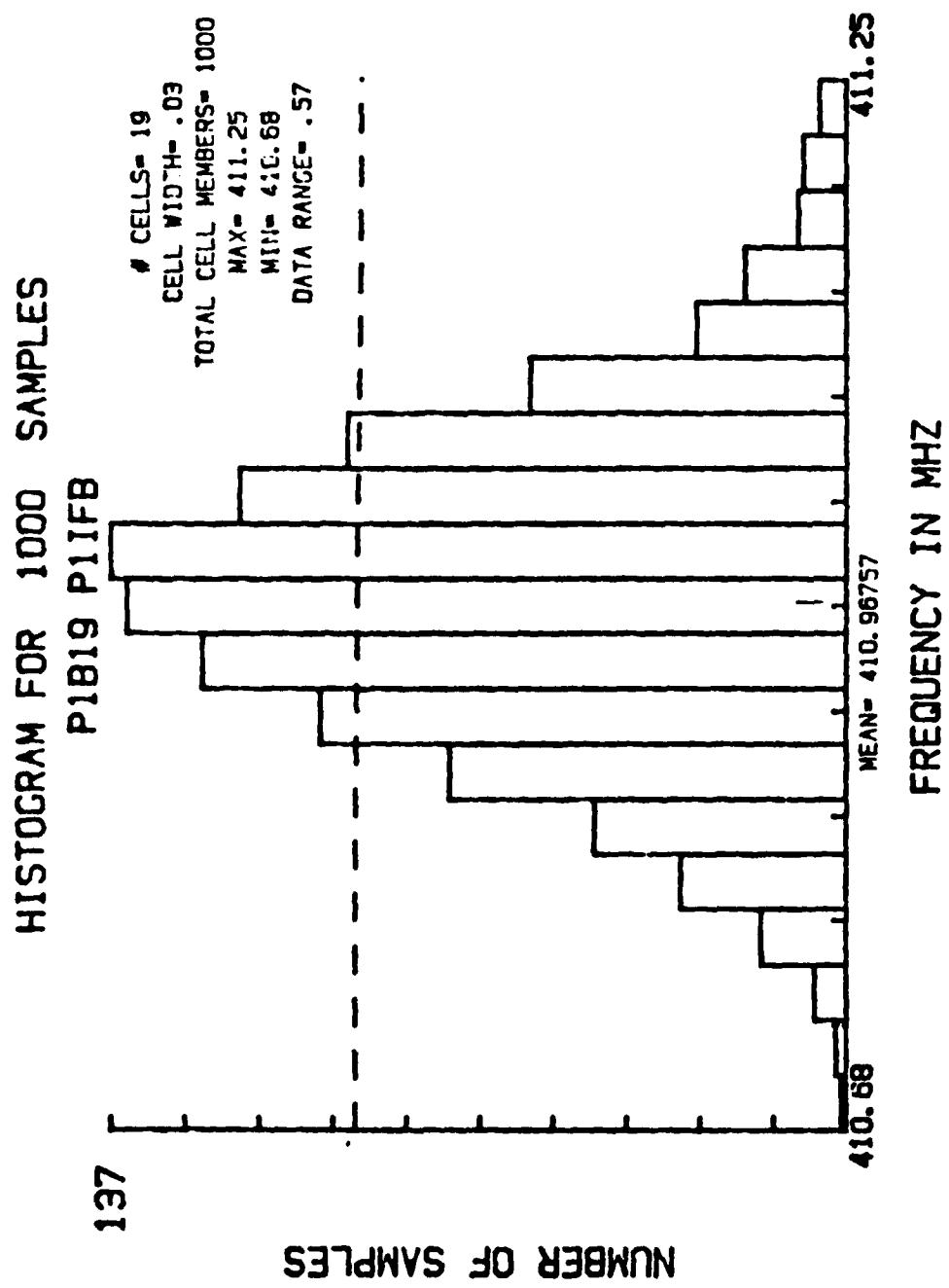
MEDIAN X VALUE= 410.68

CELL WIDTH= 3.35294117647E-2

DATA RANGE= .57

SUM ACTUAL= 1000

SUM EXPECTED= 998.707195516



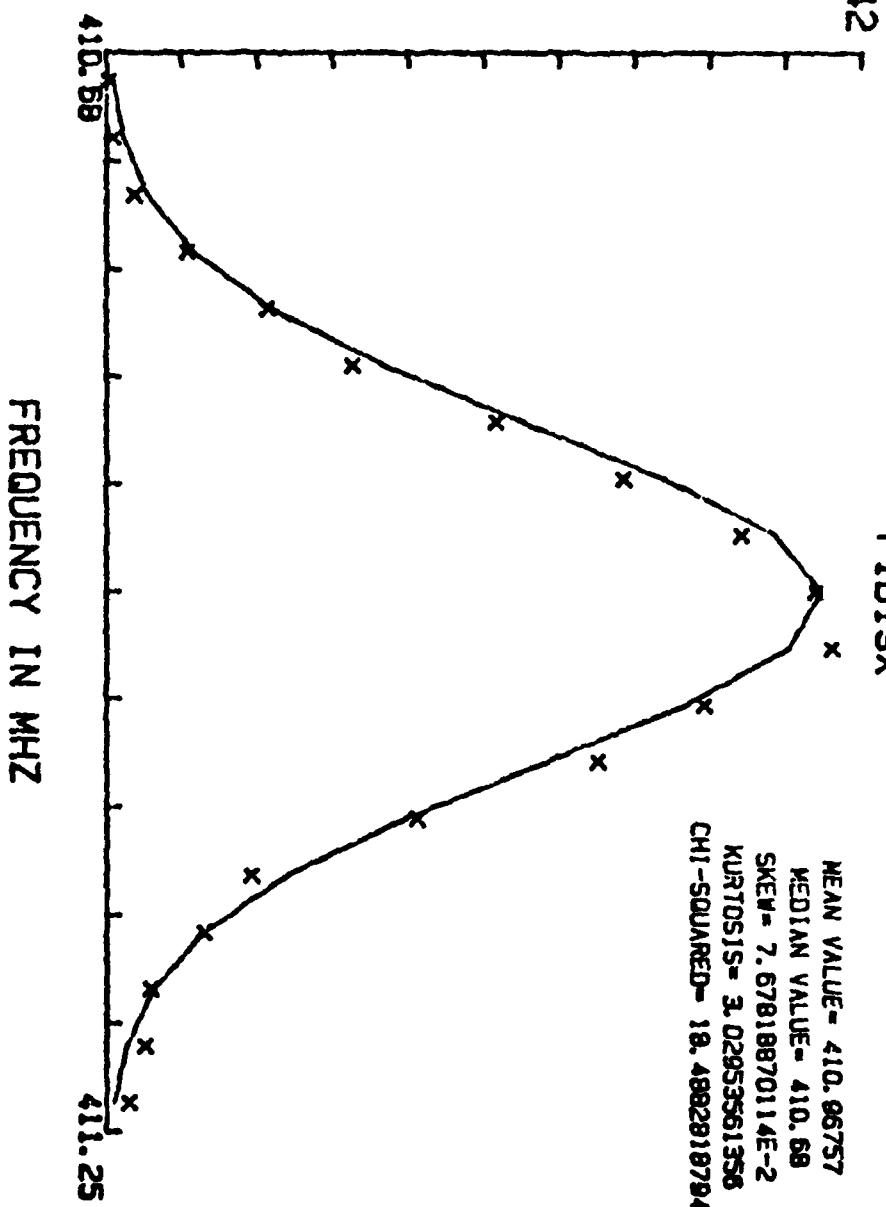
PROBABILITY FOR 19 CELLS

142

P1B19X

MEAN VALUE= 410. 96757
MEDIAN VALUE= 410. 68
SKEW= 7. 67818870114E-2
KURTOSIS= 3. 02953561356
CHI-SQUARED= 18. 4882818784

NUMBER OF SAMPLES



FILE P1B19X

MIN=410.68

MAX=411.25

CELL #	CENTER	# SAMPLES	EXPECTED
1	410.70	1	1.243
2	410.73	2	3.292
3	410.76	6	7.786
4	410.79	16	16.438
5	410.82	31	30.981
6	410.85	47	52.126
7	410.88	74	78.298
8	410.91	98	104.994
9	410.94	120	125.690
10	410.97	134	134.326
11	411.00	137	128.157
12	411.03	113	109.156
13	411.06	93	83.000
14	411.09	59	56.342
15	411.12	28	34.143
16	411.15	19	18.471
17	411.18	9	8.921
18	411.21	8	3.847
19	411.24	5	1.481

STANDARD DEVIATION= .0891

COEFF OF SKEWNESS= +.0768

COEFF OF KURTOSIS= 3.0295

CHI-SQUARED= 18.4883

MEDIAN X VALUE= 410.6800

CELL WIDTH= .030000

DATA RANGE= .570

SUM ACTUAL=1000

SUM EXPECTED= 998.6901

HISTOGRAM FOR 1000 SAMPLES

P1847 P11FB

137

NUMBER OF SAMPLES

CELLS= 21

CELL WIDTH= 2.71428571429E-2

TOTAL CELL MEMBERS= 1000

MAX= 411.25

MIN= 410.68

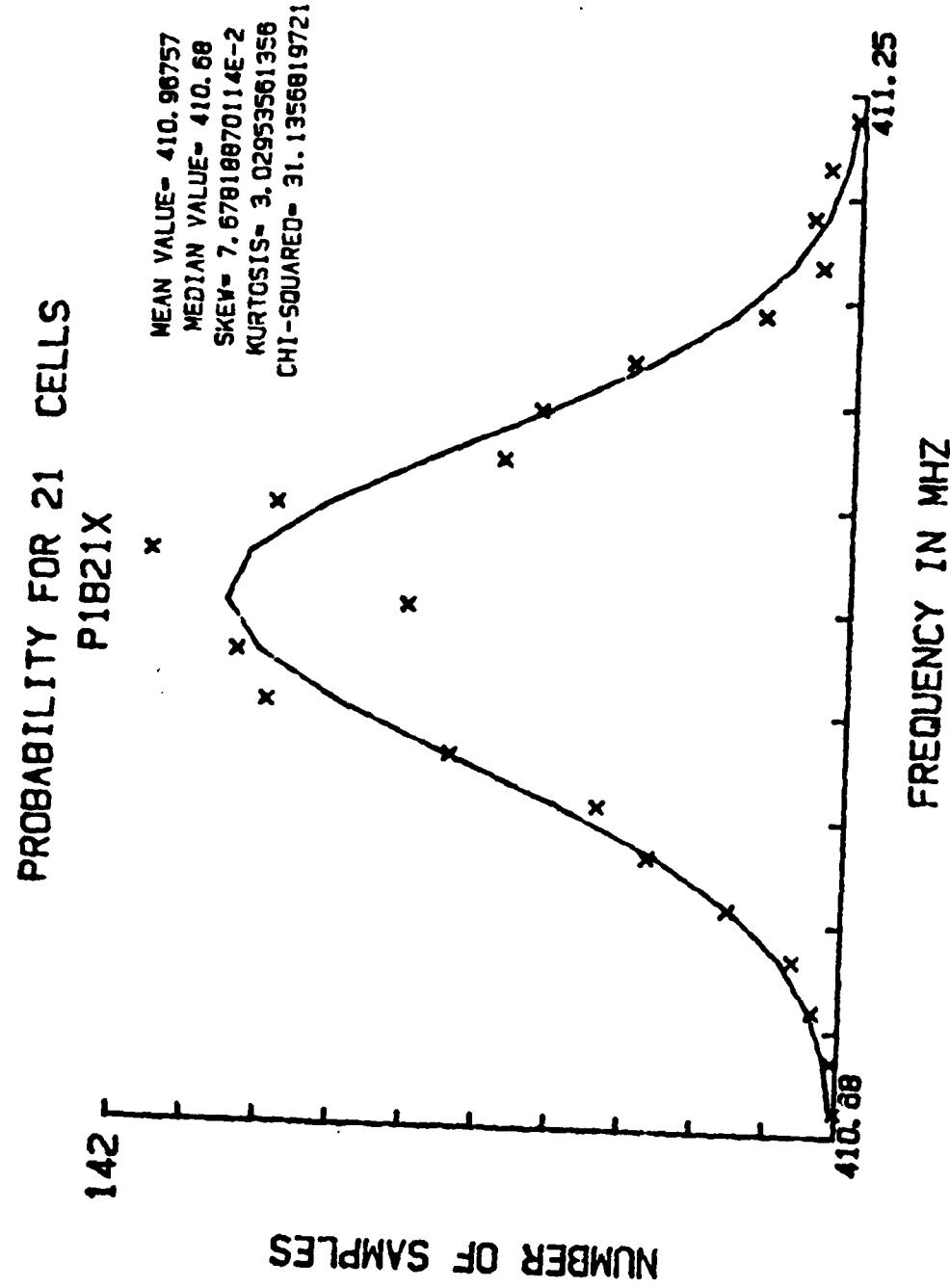
DATA RANGE= .57

MEAN= 410.98757

411.25

410.68

FREQUENCY IN MHZ



FILE P1B21X

MIN=410.68

MAX=411.25

CELL #	CENTER	# SAMPLES	EXPECTED
1	410.69	1	1.071
2	410.72	2	2.610
3	410.75	6	5.799
4	410.78	10	11.740
5	410.80	23	21.662
6	410.83	39	36.423
7	410.86	49	55.610
8	410.88	78	77.932
9	410.91	114	99.170
10	410.94	120	115.002
11	410.97	87	121.533
12	410.99	137	117.043
13	411.02	113	102.720
14	411.05	69	82.154
15	411.07	62	59.878
16	411.10	44	39.771
17	411.13	19	24.073
18	411.16	8	13.279
19	411.18	10	6.675
20	411.21	7	3.058
21	411.24	2	1.276

STANDARD DEVIATION= 8.90617488038E-2

COEFF OF SKEWNESS= 7.67818870114E-2

COEFF OF KURTOSIS= 3.02953561356

CHI-SQUARED= 31.1356819721

MEDIAN X VALUE= 410.68

CELL WIDTH= 2.71428571429E-2

DATA RANGE= .57

SUM ACTUAL= 1000

SUM EXPECTED= 998.677568391

Frequency Sampled Data - P1IF1

The statistical results of frequency sampled data P1IF1 are presented on the following 13 pages. Histogram time plot, histograms with selected number of cells, and statistical analysis are presented. The TEST RESULTS SECTION of this report contains summary statistical information associated with this frequency data set.

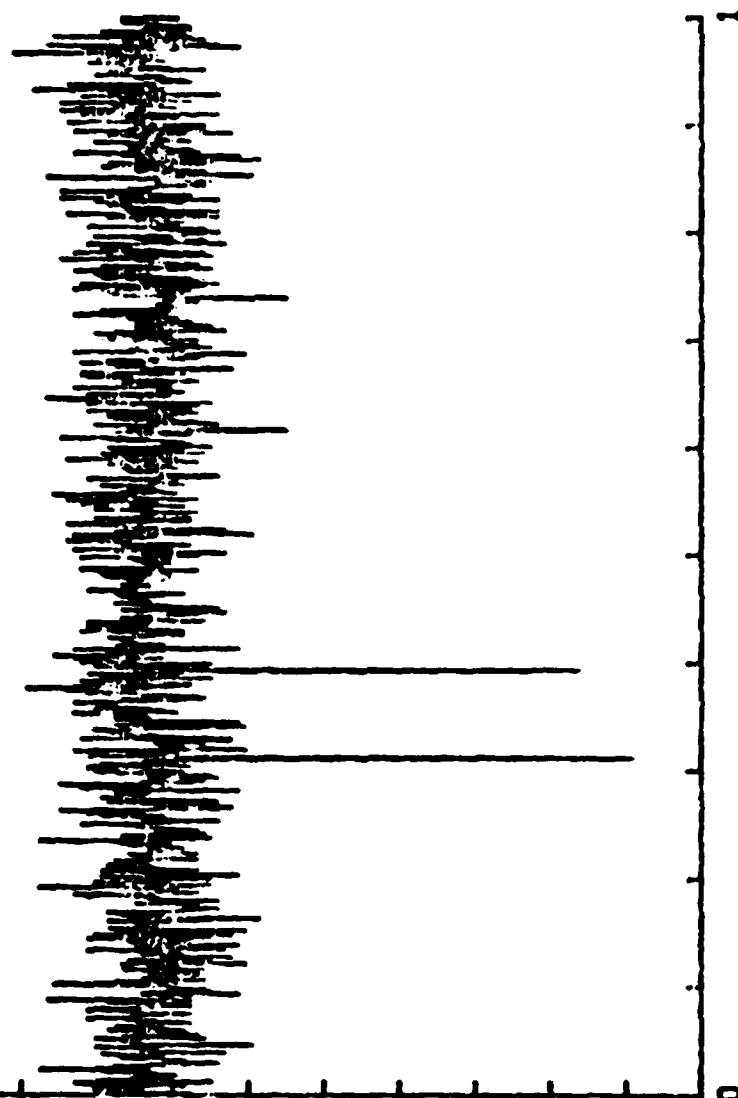
HISTOGRAM TIME PLOT
P11F1

410.5

FREQUENCY IN MHz

409.39

RELATIVE TIME



HISTOGRAM FOR 1000 SAMPLES

P1115 P11F1

198

CELLS= 15
CELL WIDTH= 2.66666666667E-2
TOTAL CELL MEMBERS= 998

MAX= 410.4

MIN= 410

DATA RANGE= .4

NUMBER OF SAMPLES

MEAN= 410.20039

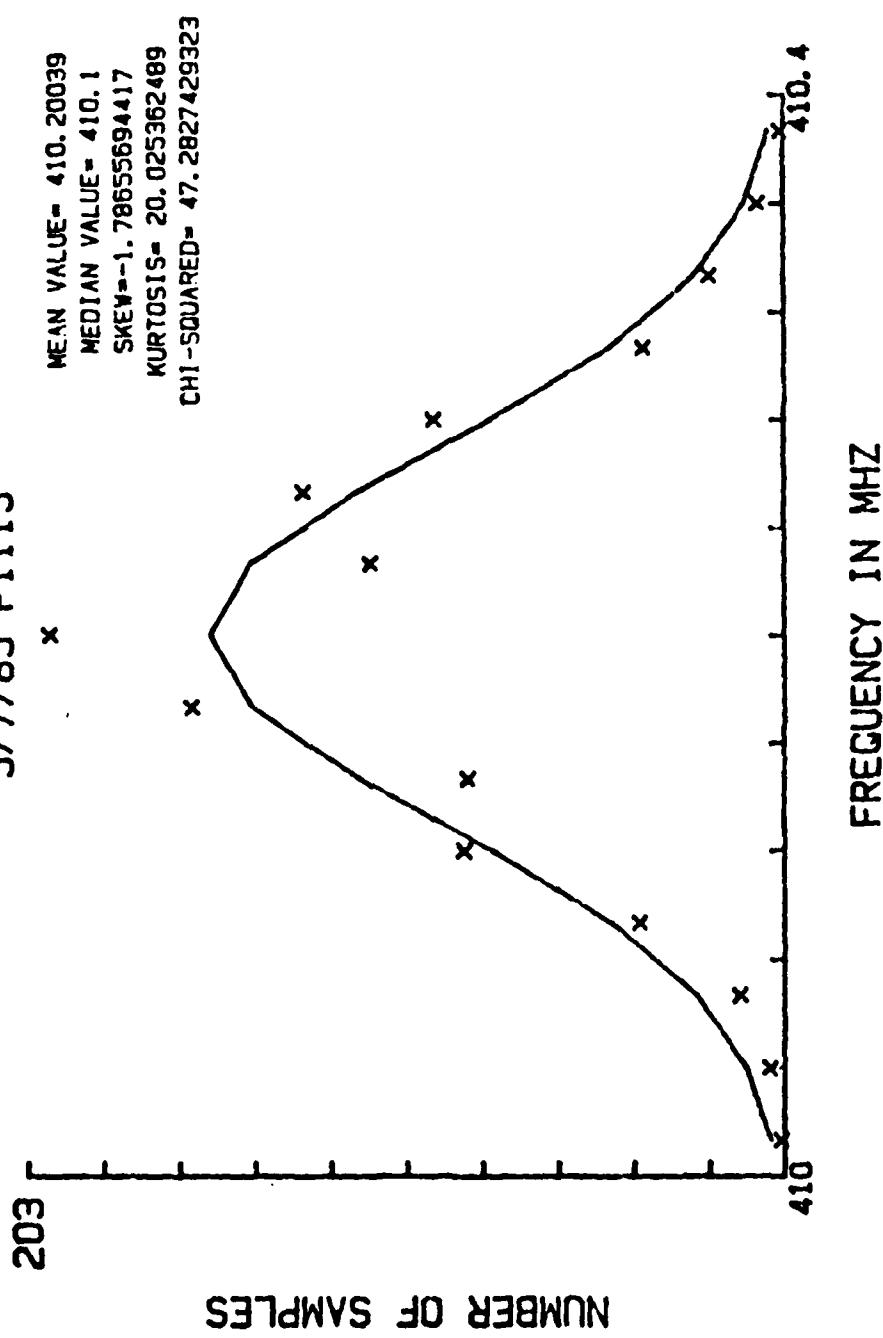
410.4

FREQUENCY IN MHZ

PROBABILITY FOR 15 CELLS

5/7/85 P1115

203



FILE P1115

MIN=410.00

MAX=410.40

CELL #	CENTER	# SAMPLES	EXPECTED
1	410.01	2	3.929
2	410.04	5	10.381
3	410.07	13	23.626
4	410.09	40	46.321
5	410.12	87	78.234
6	410.15	86	113.830
7	410.17	160	142.676
8	410.20	198	154.056
9	410.23	112	143.299
10	410.25	130	114.827
11	410.28	95	79.265
12	410.31	39	47.136
13	410.33	21	24.147
14	410.36	8	10.656
15	410.39	2	4.051

STANDARD DEVIATION=.0691

COEFF OF SKEWNESS= -1.7866

COEFF OF KURTOSIS= 20.0254

CHI-SQUARED= 47.2827

MEDIAN X VALUE= 410.1000

CELL WIDTH=.026667

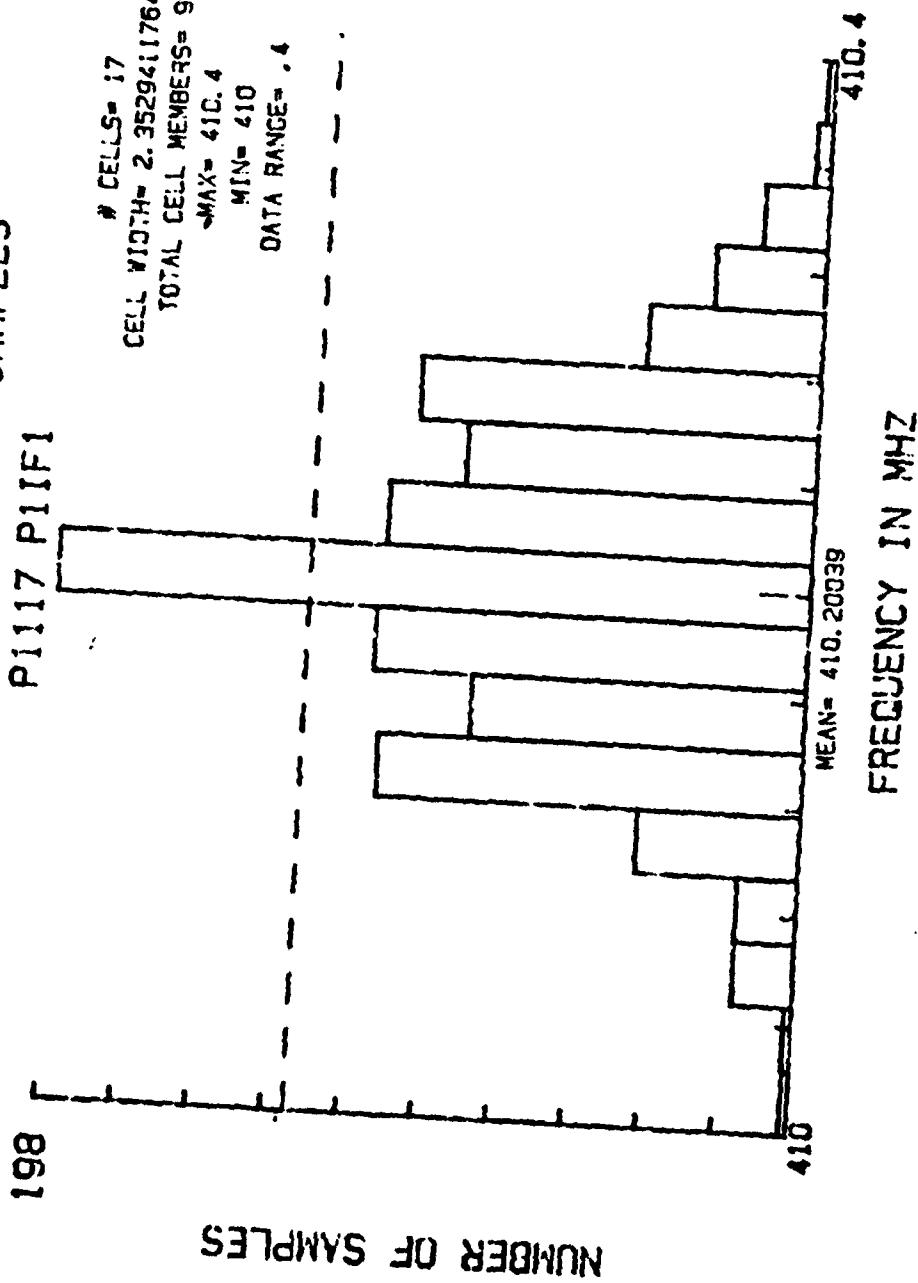
DATA RANGE=.400

SUM ACTUAL= 998

SUM EXPECTED= 996.4345

HISTOGRAM FOR 1000 SAMPLES
P1117 P11F1

CELLS= 17
CELL WIDTH= 2.35294E17647E-2
TOTAL CELL MEMBERS= 998
MAX= 410.4
MIN= 410
DATA RANGE= .4



PROBABILITY FOR 17 CELLS

5/7/85 P1117

203

NUMBER OF SAMPLES

MEAN VALUE= 410.20039
MEDIAN VALUE= 410.1
SKEW=-1.78655694417
KURTOSIS= 20.025352489
CHI-SQUARED= 76.1577477C07

FREQUENCY IN MHZ

410.4
410.3
410.2
410.1
410.0

FILE P1117

MIN=410.00

MAX=410.40

CELL #	CENTER	# SAMPLES	EXPECTED
1	410.01	2	3.259
2	410.04	2	7.801
3	410.06	16	16.623
4	410.08	16	31.540
5	410.11	43	53.285
6	410.13	112	80.152
7	410.15	88	107.351
8	410.18	114	128.019
9	410.20	198	135.932
10	410.22	112	128.513
11	410.25	92	108.180
12	410.27	105	81.083
13	410.29	46	54.111
14	410.32	29	32.153
15	410.34	17	17.011
16	410.36	4	8.014
17	410.39	2	3.361

STANDARD DEVIATION=.0691

COEFF OF SKEWNESS=-1.7866

COEFF OF KURTOSIS=20.0254

CHI-SQUARED=76.1677

MEDIAN X VALUE=410.1000

CELL WIDTH=.023529

DATA RANGE=.400

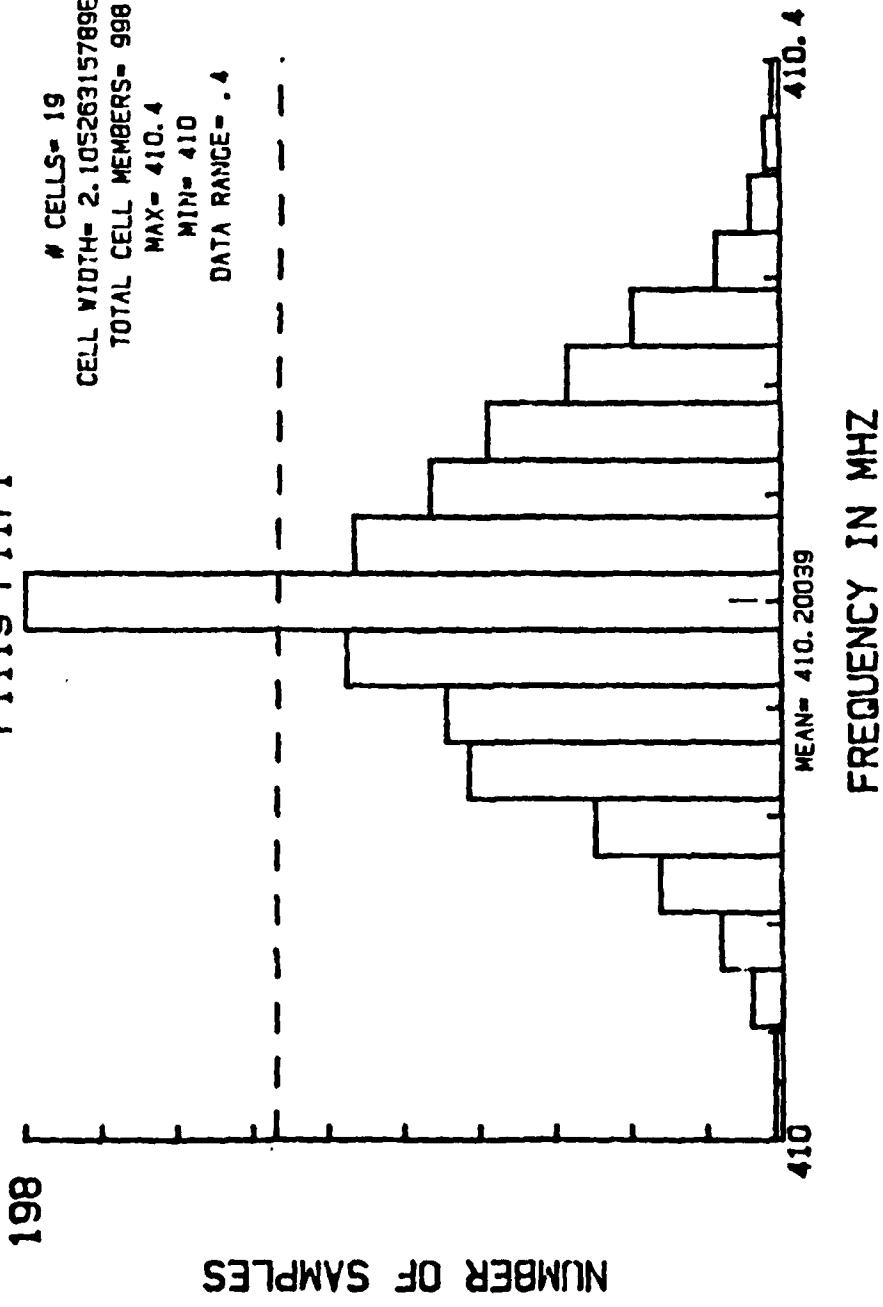
SUM ACTUAL=998

SUM EXPECTED=996.3886

HISTOGRAM FOR 1000 SAMPLES

P1119 P11F1

CELLS= 19
CELL WIDTH= 2.10526315789E-2
TOTAL CELL MEMBERS= 998
MAX= 410.4
MIN= 410
DATA RANGE= -4



PROBABILITY FOR 19 CELLS

5/7/85 P1119

203

MEAN VALUE= 410.20039

MEDIAN VALUE= 410.1

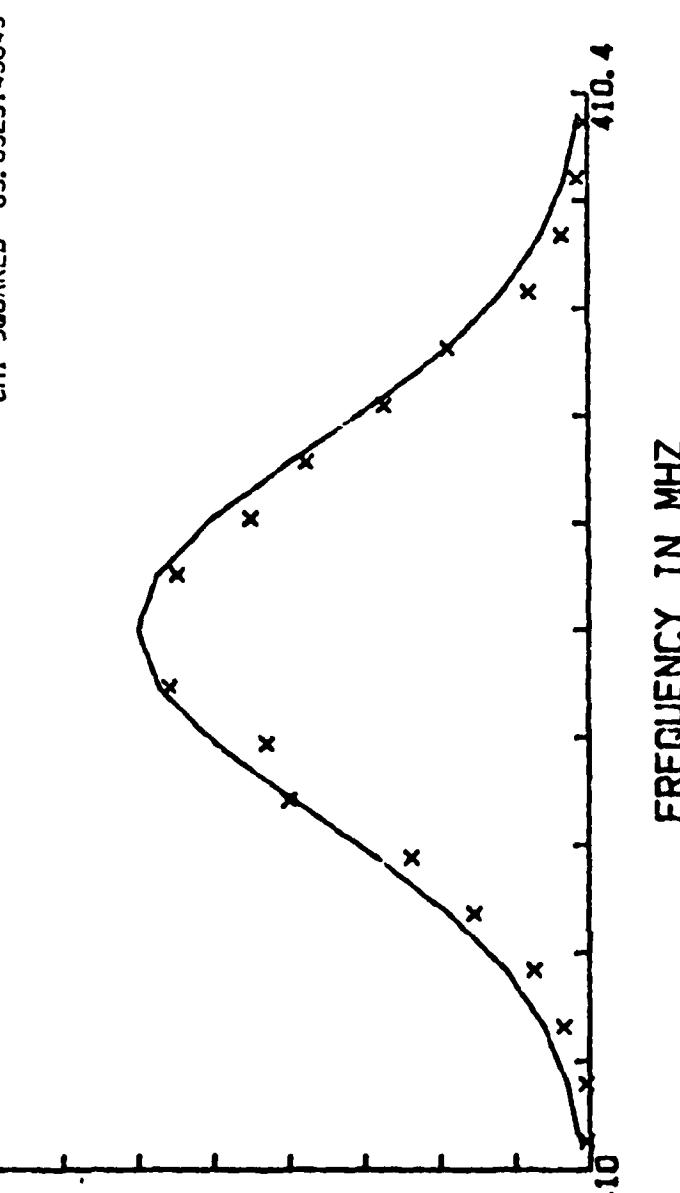
SKEW=-1.78655694417

KURTOSIS= 20.025362489

CHI-SQUARED= 63.9523143045

NUMBER OF SAMPLES

B-36



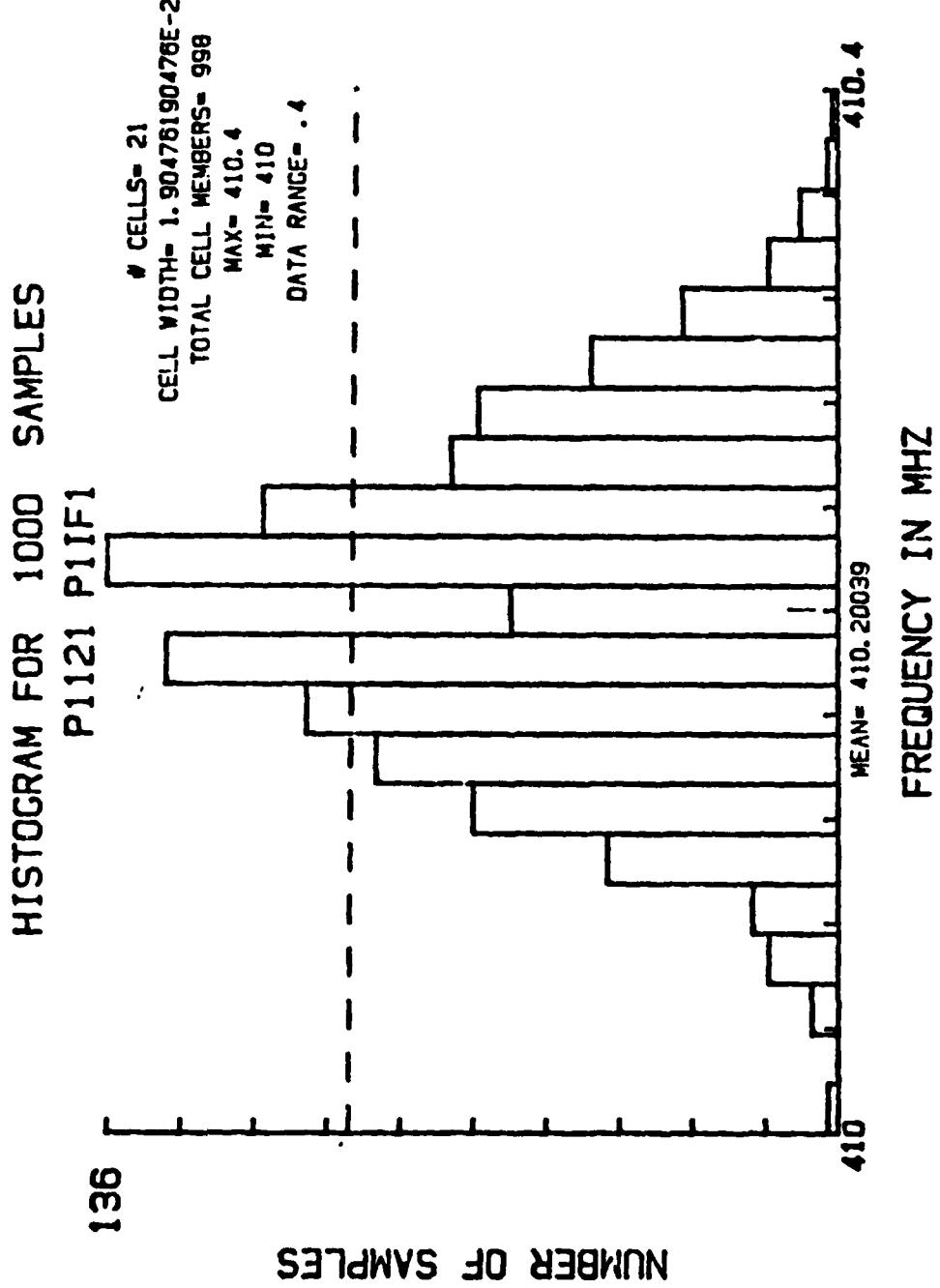
FILE P1119

MIN=410.00

MAX=410.40

CELL #	CENTER	# SAMPLES	EXPECTED
1	410.01	2	2.776
2	410.03	2	6.128
3	410.05	8	12.326
4	410.07	16	22.592
5	410.09	32	37.732
6	410.12	49	57.425
7	410.14	82	79.639
8	410.16	88	100.644
9	410.18	114	115.901
10	410.20	198	121.623
11	410.22	112	116.300
12	410.24	92	101.340
13	410.26	77	80.466
14	410.28	56	58.221
15	410.31	39	38.387
16	410.33	17	23.063
17	410.35	8	12.627
18	410.37	4	6.299
19	410.39	2	2.864

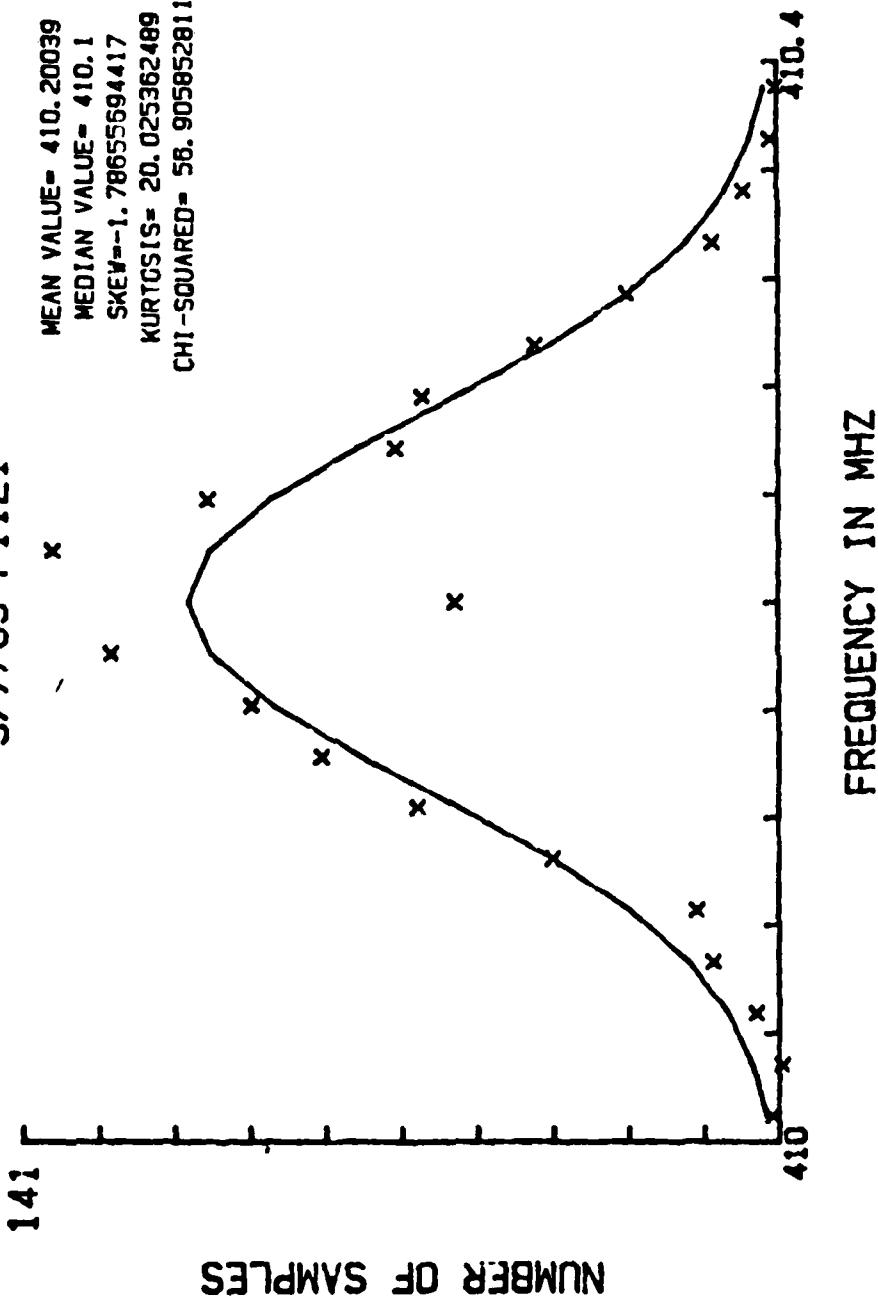
STANDARD DEVIATION= .0691
 COEFF OF SKEWNESS= -1.7866
 COEFF OF KURTOSIS= 20.0254
 CHI-SQUARED= 63.8523
 MEDIAN X VALUE= 410.1000
 CELL WIDTH= .021053
 DATA RANGE= .400
 SUM ACTUAL= 998
 SUM EXPECTED= 996.3560



PROBABILITY FOR 21 CELLS

5/7/85 P1121

MEAN VALUE= 410.20039
MEDIAN VALUE= 410.1
SKEW=-1.78655694417
KURTOSIS= 20.025362489
CHI-SQUARED= 58.9058528112



FILE P1121

MIN=410.00

MAX=410.40

CELL #	CENTER	# SAMPLES	EXPECTED
1	410.01	2	2.413
2	410.03	0	4.980
3	410.05	5	9.523
4	410.07	13	16.876
5	410.09	16	27.715
6	410.10	43	42.182
7	410.12	68	59.498
8	410.14	86	77.773
9	410.16	99	94.213
10	410.18	125	105.768
11	410.20	61	110.040
12	410.22	136	106.098
13	410.24	107	94.802
14	410.26	72	78.503
15	410.28	67	60.244
16	410.30	46	42.845
17	410.31	29	28.238
18	410.33	13	17.248
19	410.35	7	9.763
20	410.37	2	5.122
21	410.39	1	2.490

STANDARD DEVIATION= .0691
COEFF OF SKEWNESS= -1.7866
COEFF OF KURTOSIS= 20.0254
CHI-SQUARED= 56.9059
MEDIAN X VALUE= 410.1000
CELL WIDTH= .019048
DATA RANGE= .400
SUM ACTUAL= 998
SUM EXPECTED= 996.3322

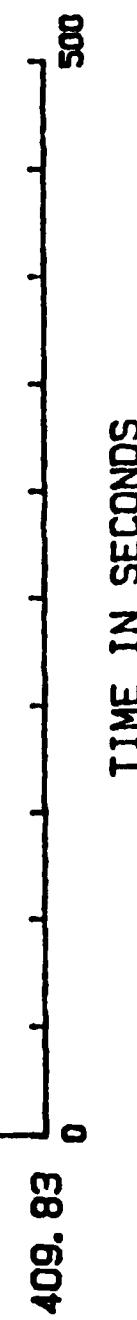
Frequency Sampled Data - P11F2

The statistical results of frequency sampled data P11F2 are presented on the following 13 pages. Histogram time plot, histograms with selected number of cells, and statistical analysis are presented. The TEST RESULTS SECTION of this report contains summary statistical information associated with this frequency data set.

HISTOGRAM TIME PLOT
5/2/85 P11F2

410.33

FREQUENCY IN MHz



HISTOGRAM FOR 1000 SAMPLES

P1213 P11F2

214

214

NUMBER OF SAMPLES

CELLS= 13
CELL WIDTH= 2. 30769230769E-2
TOTAL CELL MEMBERS= 1000
MAX= 410. 23
MIN= 409. 93
DATA RANGE= . 3

4:G. 23

MEAN= 410. 07137

FREQUENCY IN MHZ

409. 93

PROBABILITY FCR 13 CELLS

P1213X

MEAN VALUE= 410.07137

MEDIAN VALUE= 409.93

SKEW= .129786709317

KURTOSIS= 2.93653623268

CHI-SQUARED= 46.476380622

219

NUMBER OF SAMPLES

410.23

FREQUENCY IN MHZ

FILE P1213X

MIN=409.93

MAX=410.23

CELL #	CENTER	# SAMPLES	EXPECTED
1	409.94	9	7.295
2	409.96	18	20.584
3	409.99	36	47.444
4	410.01	119	89.318
5	410.03	135	137.341
6	410.06	148	172.492
7	410.08	214	176.948
8	410.10	116	148.263
9	410.13	104	101.467
10	410.15	68	56.719
11	410.17	16	25.896
12	410.20	9	9.657
13	410.22	8	2.942

STANDARD DEVIATION= 5.12973985695E-2

COEFF OF SKEWNESS= .129786709317

COEFF OF KURTOSIS= 2.93663623268

CHI-SQUARED= 46.476380622

MEDIAN X VALUE= 409.93

CELL WIDTH= 2.30769230769E-2

DATA RANGE= .3

SUM ACTUAL= 1000

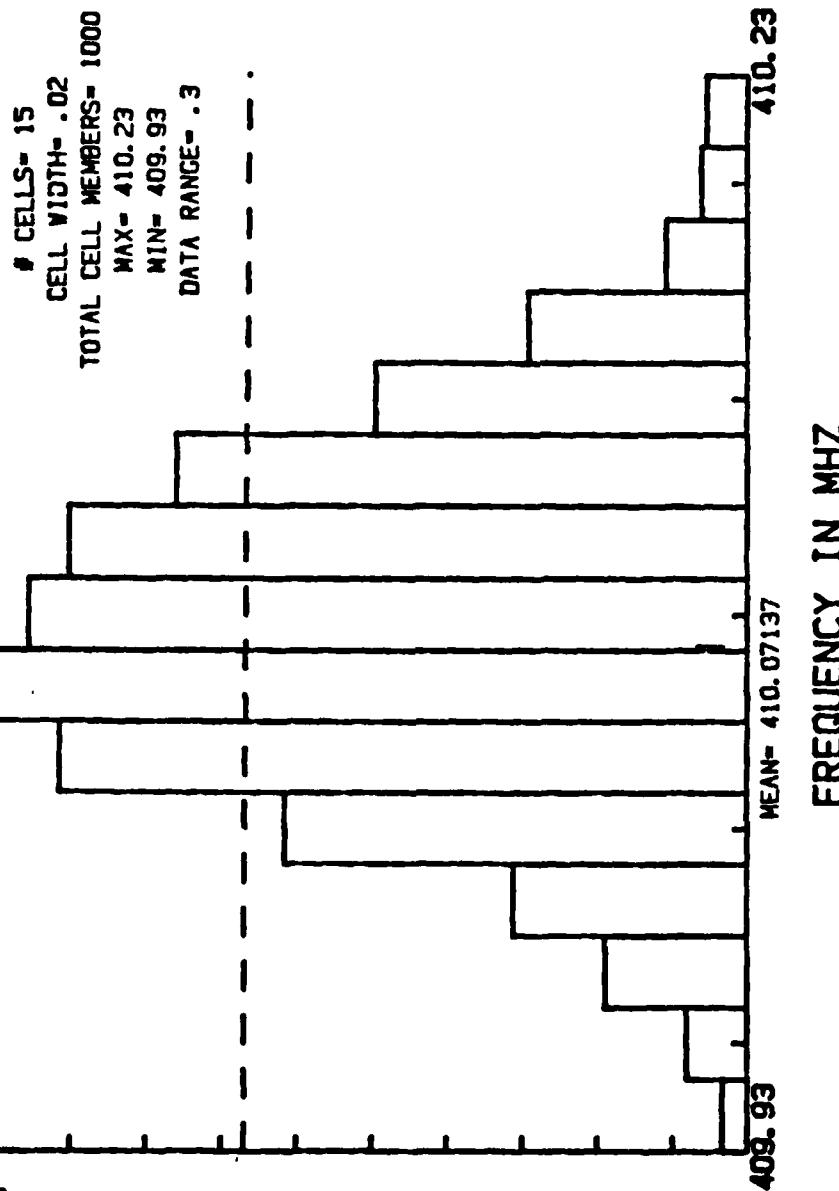
SUM EXPECTED= 996.366649035

HISTOGRAM FOR 1000 SAMPLES

P1IF2

148

NUMBER OF SAMPLES



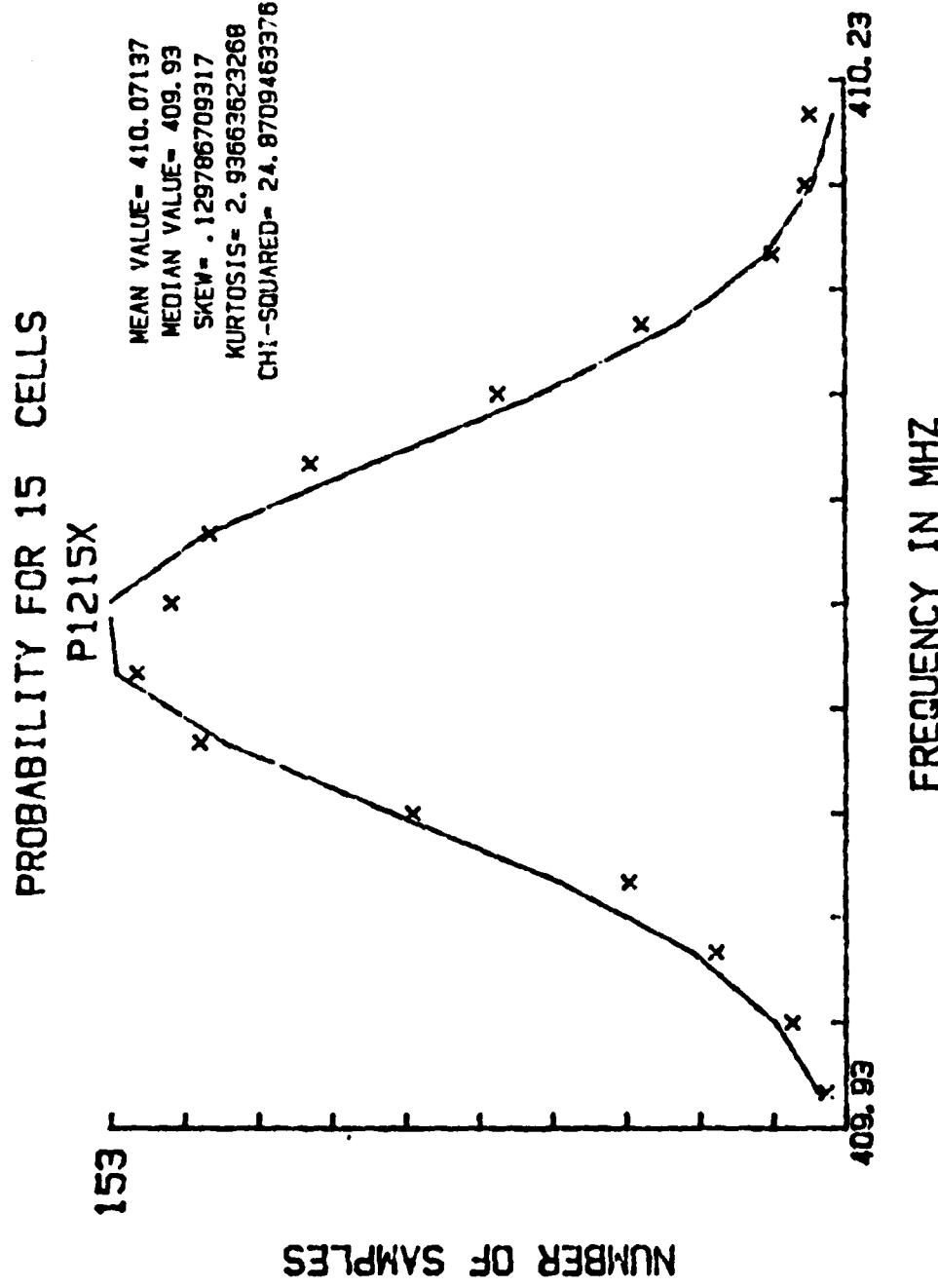
CELLS- 15
CELL WIDTH- .02
TOTAL CELL MEMBERS- 1000
MAX- 410.23
MIN- 409.93
DATA RANGE- .3

FREQUENCY IN MHZ

MEAN- 410.07137

410.23

409.93



FILE P1215X

MIN=409.93

MAX=410.23

CELL #	CENTER	# SAMPLES	EXPECTED
1	409.94	5	5.857
2	409.96	12	14.734
3	409.98	28	31.836
4	410.00	46	59.089
5	410.02	91	94.207
6	410.04	135	129.014
7	410.06	148	151.767
8	410.08	141	153.355
9	410.10	133	133.108
10	410.12	112	99.241
11	410.14	73	63.557
12	410.16	43	34.964
13	410.18	16	16.522
14	410.20	9	6.706
15	410.22	8	2.338

STANDARD DEVIATION= 5.12973985695E-2

COEFF OF SKEWNESS= .129786709317

COEFF OF KURTOSIS= 2.93663623268

CHI-SQUARED= 24.8709463376

MEDIAN X VALUE= 409.93

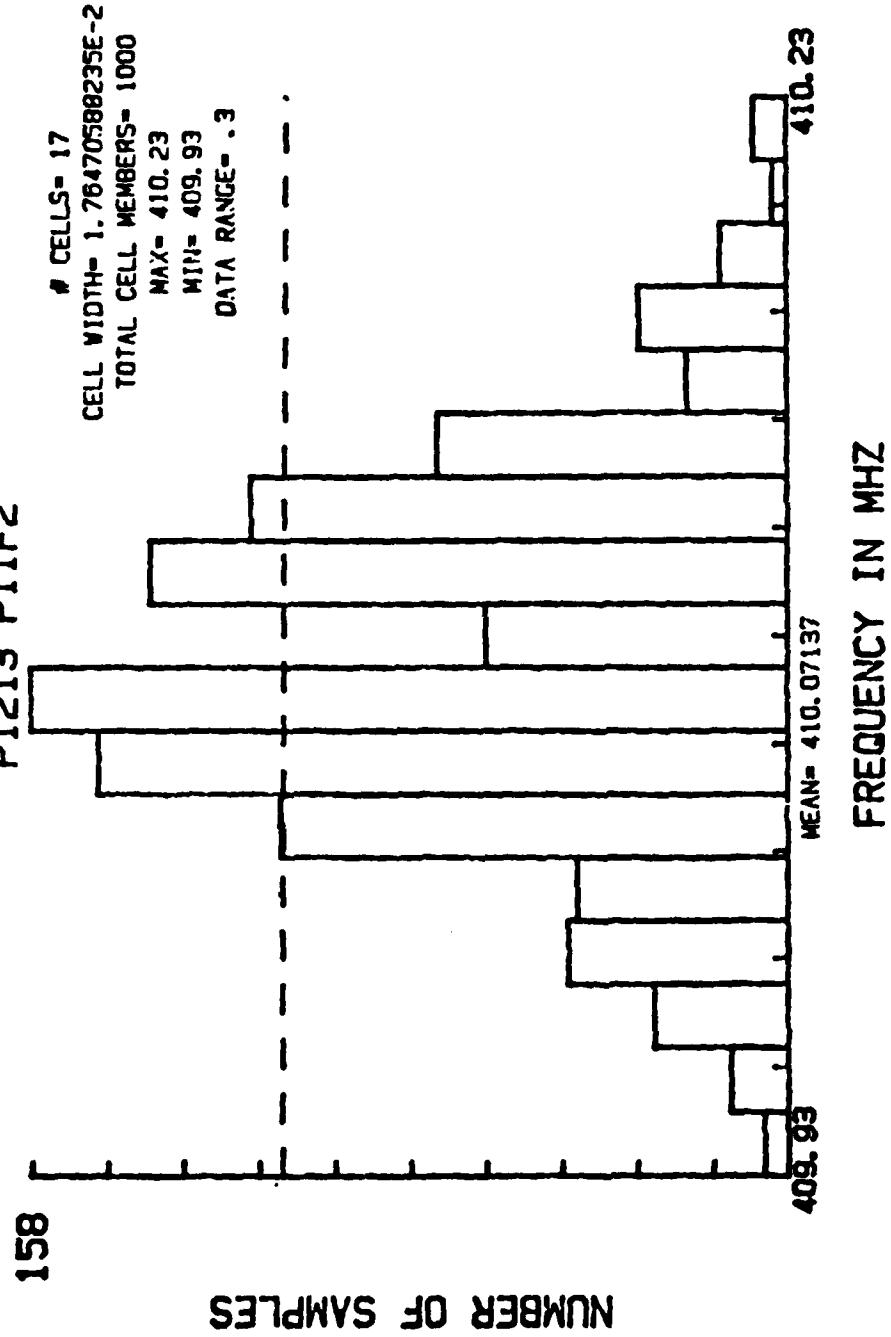
CELL WIDTH= .02

DATA RANGE= .3

SUM ACTUAL= 1000

SUM EXPECTED= 996.297115568

HISTOGRAM FOR 1000 SAMPLES
P1213 P11F2



PROBABILITY FOR 17 CELLS

P1217X

163

NUMBER OF SAMPLES

MEAN VALUE= 410.07137
MEDIAN VALUE= 409.93
SKEW= .129786709317
KURTOSIS= 2.93663623268
CHI-SQUARED= 90.6002403574

FREQUENCY IN MHZ

410.23

FILE P1217X

MIN=409.93

MAX=410.23

CELL #	CENTER	# SAMPLES	EXPECTED
1	409.94	5	4.872
2	409.96	12	11.170
3	409.97	28	22.751
4	409.99	46	41.167
5	410.01	44	66.177
6	410.03	106	94.506
7	410.04	144	119.899
8	410.06	158	135.138
9	410.08	63	135.314
10	410.10	133	120.367
11	410.12	112	95.121
12	410.13	73	66.781
13	410.15	21	41.651
14	410.17	31	23.078
15	410.19	14	11.360
16	410.20	3	4.968
17	410.22	7	1.930

STANDARD DEVIATION= 5.12973985695E-2

COEFF OF SKEWNESS= .129786709317

COEFF OF KURTOSIS= 2.93663623268

CHI-SQUARED= 90.6002403574

MEDIAN X VALUE= 409.93

CELL WIDTH= 1.76470588235E-2

DATA RANGE= .3

SUM ACTUAL= 1000

SUM EXPECTED= 996.250022062

HISTOGRAM FOR 1000 SAMPLES

P1219 P1IF2

158

CELLS= 19
CELL WIDTH= 1.57094736842E-2
TOTAL CELL MEMBERS= 1000

MAX= 410.23

MIN= 409.93

DATA RANGE=.3

NUMBER OF SAMPLES

MEAN= 410.07137

410.23

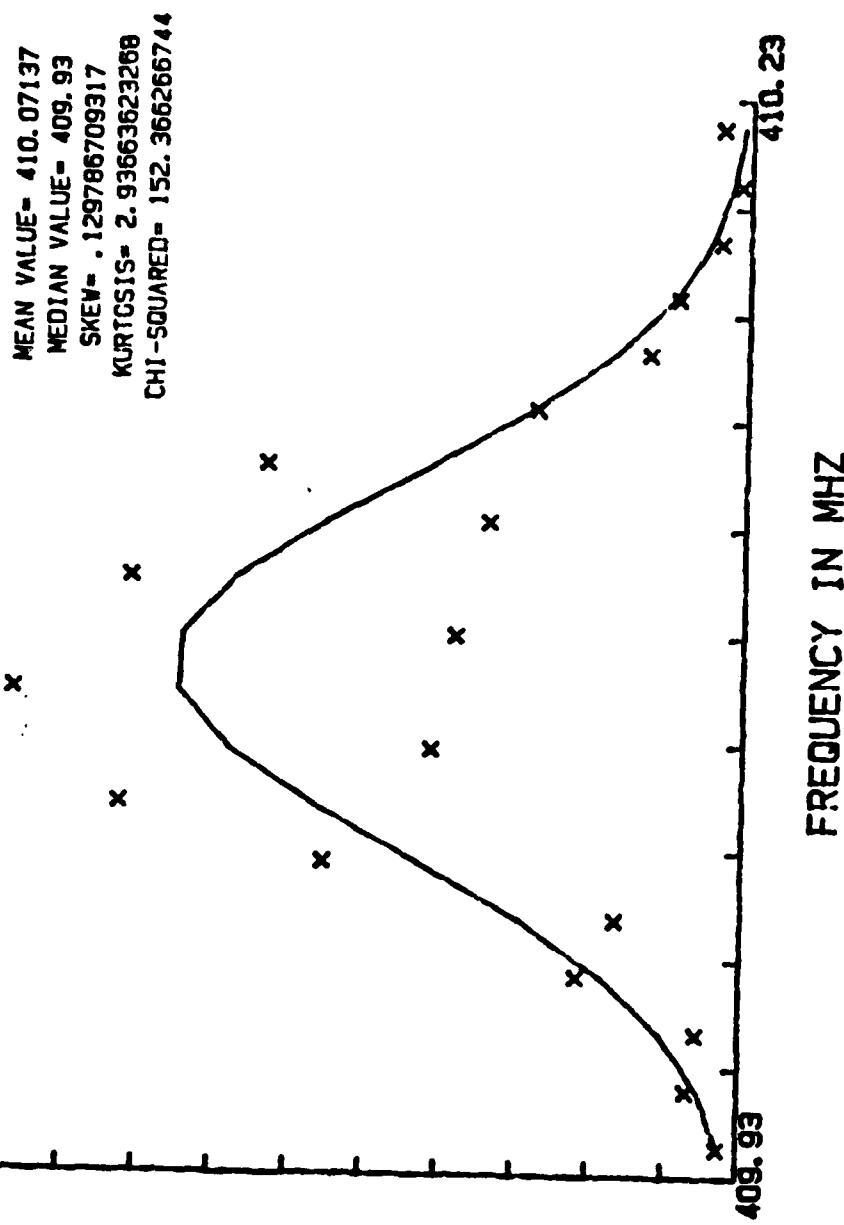
409.93

FREQUENCY IN MHZ

PROBABILITY FOR 19 CELLS
P1219X

163

NUMBER OF SAMPLES



FILE P1219X

MIN=409.93

MAX=410.23

CELL #	CENTER	# SAMPLES	EXPECTED
1	409.94	5	4.159
2	409.95	12	8.836
3	409.97	10	17.076
4	409.99	36	30.015
5	410.00	28	47.991
6	410.02	91	69.795
7	410.03	135	92.331
8	410.05	68	111.102
9	410.06	158	121.605
10	410.08	63	121.070
11	410.10	133	109.641
12	410.11	56	90.316
13	410.13	104	67.672
14	410.14	46	46.122
15	410.16	22	28.593
16	410.17	16	16.124
17	410.19	7	8.271
18	410.21	3	3.859
19	410.22	7	1.638

STANDARD DEVIATION= 5.12973985695E-2

COEFF OF SKEWNESS= .129786709317

COEFF OF KURTOSIS= 2.93663623268

CHI-SQUARED= 152.366266744

MEDIAN X VALUE= 409.93

CELL WIDTH= 1.57894736842E-2

DATA RANGE= .3

SUM ACTUAL= 1000

SUM EXPECTED= 996.216703606

APPENDIX C

Introduction

ELINT parameter test results are contained in this appendix for the ELINT pulsewidth parameter associated with the AN/PPS-6 radar. Two sets of the pulsewidth sampled data were collected and the analyzed results are presented in this appendix. The pulsewidth data sets are labelled P1PWA and P1PWB.

Pulsewidth Sampled Data - P1PWA

The statistical results of pulsewidth sampled data P1PWA are presented on the next 11 pages. Histogram time plot, histograms with selected number of cells, and statistical analysis are presented.

The test results section of this report contains summary statistical information associated with this pulsewidth data set.

HISTOGRAM TIME PLOT
IF PULSE WIDTH P1PWA

220.28

TIME IN NANoseconds

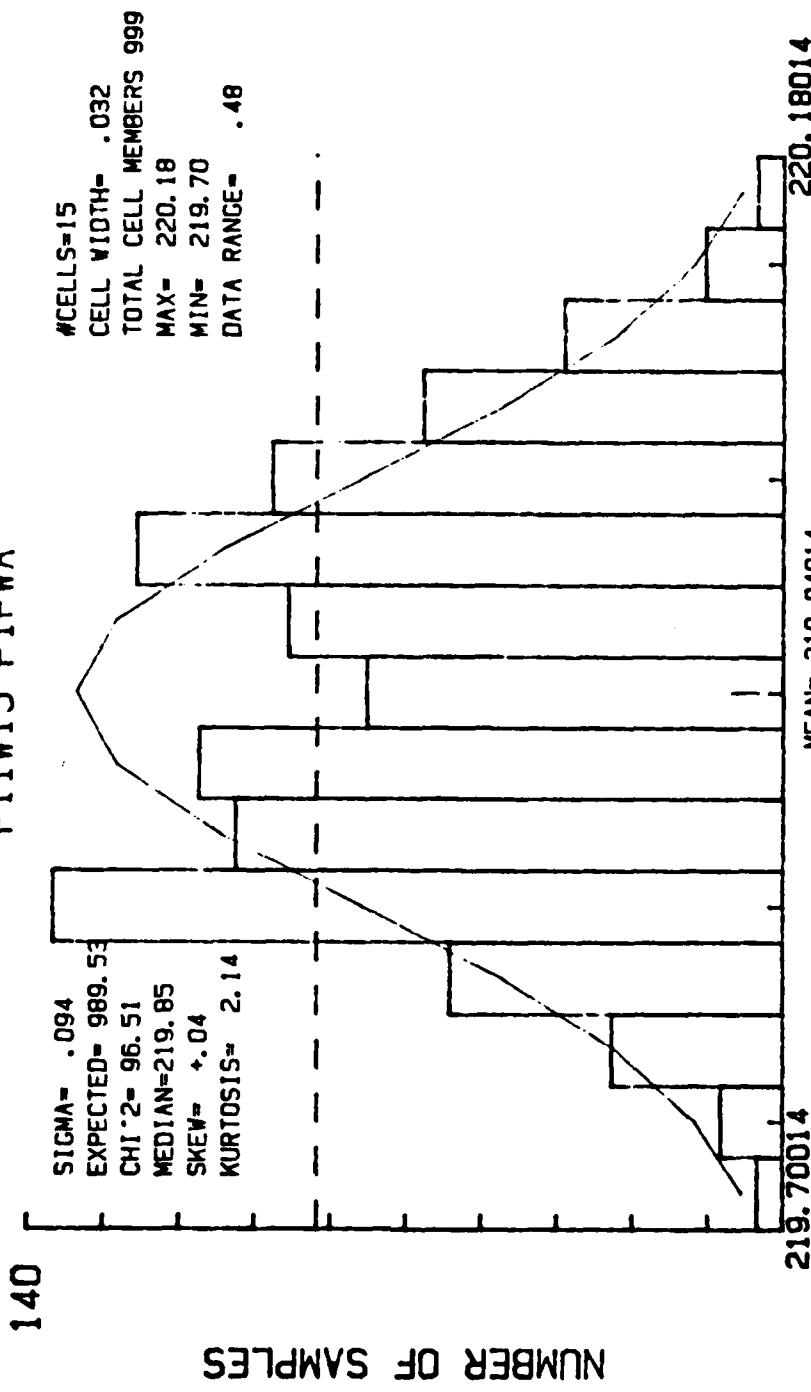
219.6

RELATIVE TIME



C-3

HISTOGRAM FOR 1000 SAMPLES
P1I1W15 P1PWA



MEAN= 219.94014
IF PULSE WIDTH IN NS

FILE PLIW15

PLOT MIN= 219.70 PLOT MAX= 220.18
DATA MIN= 219.70 DATA MAX= 220.18

CELL #	CENTER	# SAMPLES	EXPECTED
1	219.72	5	8.022
2	219.75	12	16.983
3	219.78	33	32.034
4	219.81	64	53.840
5	219.84	140	80.628
6	219.88	105	107.587
7	219.91	112	127.915
8	219.94	80	135.512
9	219.97	95	127.915
10	220.00	124	107.587
11	220.04	98	80.628
12	220.07	69	53.840
13	220.10	42	32.034
14	220.13	15	16.983
15	220.16	5	8.022

MEAN VALUE= 219.9401

STANDARD DEVIATION= .0942

COEFF OF SKEWNESS= +.0360

COEFF OF KURTOSIS= 2.1438

CHI-SQUARED= 96.5056

MEDIAN X VALUE= 219.8500

CELL WIDTH= .032000

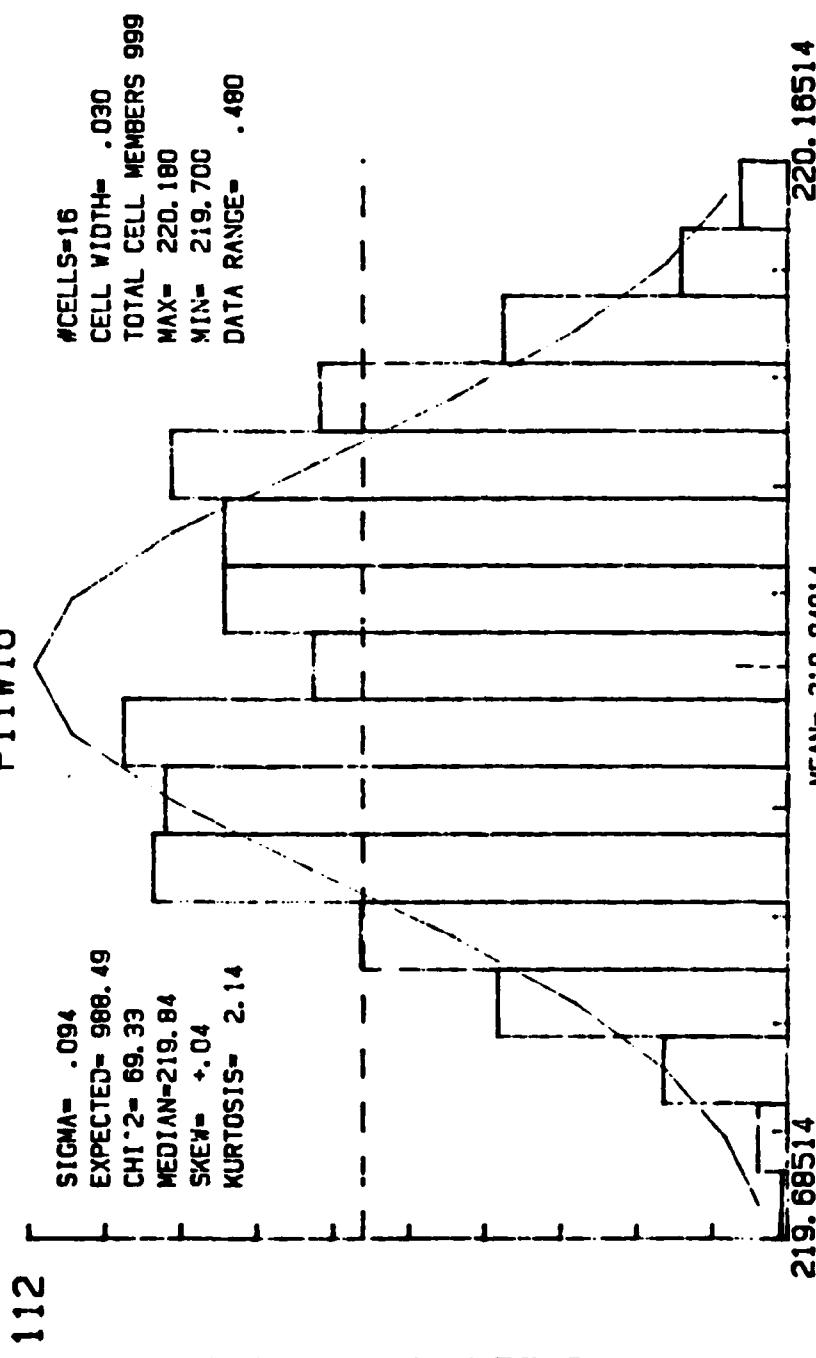
DATA RANGE= .480

SUM ACTUAL= 999

SUM EXPECTED= 989.5289

65.7 PERCENT OF DATA LIES BETWEEN 219.83 AND 220.02

HISTOGRAM FOR 16 CELLS
P11W16



PLOT MIN= 219.69 PLOT MAX= 220.17
DATA MIN= 219.70 DATA MAX= 220.18

CELL #	CENTER	# SAMPLES	EXPECTED
1	219.70	1	4.950
2	219.73	5	10.591
3	219.76	21	20.474
4	219.79	49	35.763
5	219.82	72	56.444
6	219.85	107	80.494
7	219.88	105	103.721
8	219.91	112	120.761
9	219.94	80	127.042
10	219.97	95	120.761
11	220.00	95	103.721
12	220.03	104	80.494
13	220.06	79	56.444
14	220.09	48	35.763
15	220.12	18	20.474
16	220.15	8	10.591

MEAN VALUE= 219.9401

STANDARD DEVIATION= .0942

COEFF OF SKEWNESS= +.0360

COEFF OF KURTOSIS= 2.1438

CHI-SQUARED= 69.3299

MEDIAN X VALUE= 219.8400

CELL WIDTH= .030000

DATA RANGE= .480

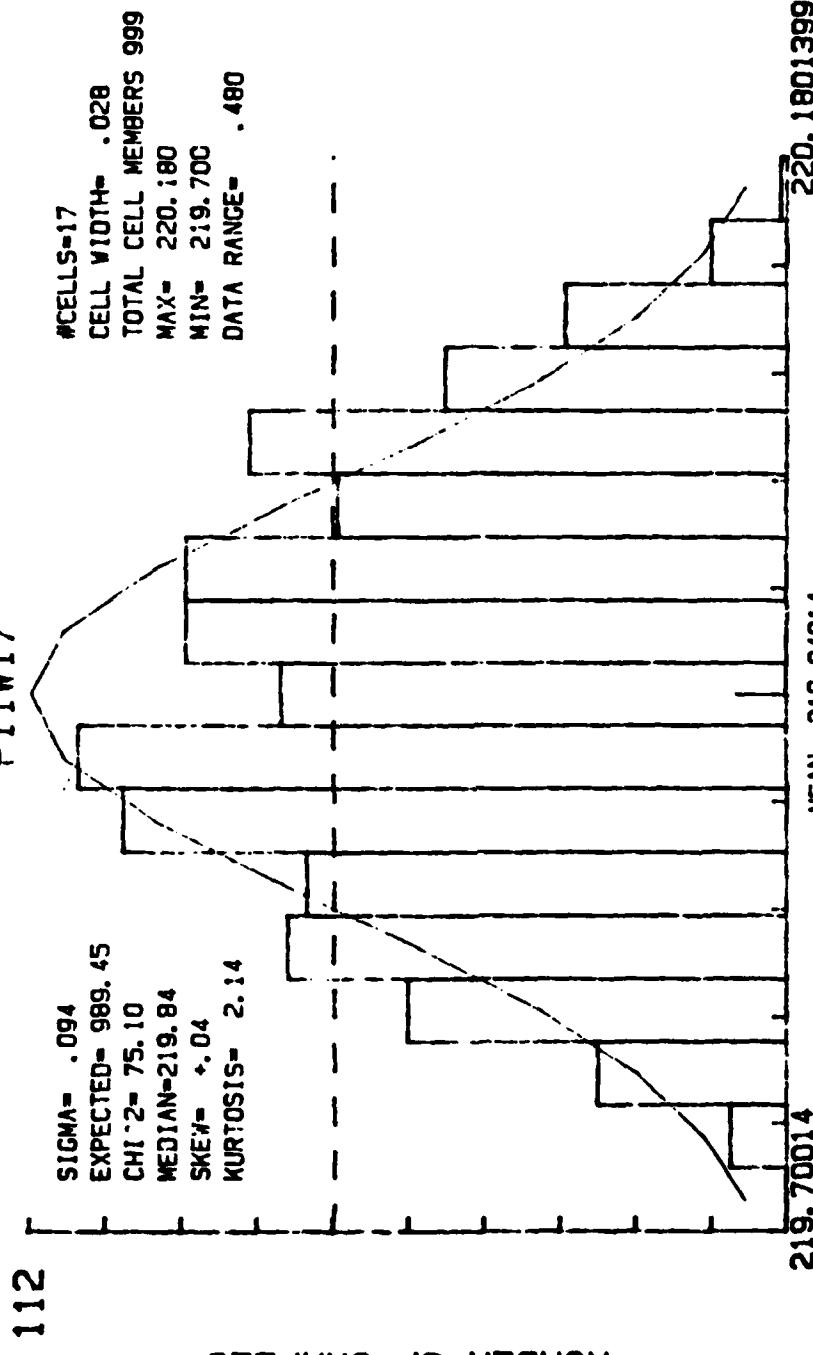
SUM ACTUAL= 999

SUM EXPECTED= 988.4873

69.9PERCENT OF DATA LIES BETWEEN 219.84 AND 220.05

HISTOGRAM FOR 17 CELLS

P11W17



220.180139998

IF PULSE WIDTH IN NS

PLOT MIN= 219.70 PLOT MAX= 220.18
DATA MIN= 219.70 DATA MAX= 220.18

CELL #	CENTER	# SAMPLES	EXPECTED
1	219.71	0	6.749
2	219.74	9	13.238
3	219.77	30	23.735
4	219.80	60	38.901
5	219.83	79	58.280
6	219.86	76	79.811
7	219.88	105	99.907
8	219.91	112	114.317
9	219.94	80	119.569
10	219.97	95	114.317
11	220.00	95	99.907
12	220.02	71	79.811
13	220.05	85	58.280
14	220.08	54	38.901
15	220.11	35	23.735
16	220.14	12	13.238
17	220.17	1	6.749

MEAN VALUE= 219.9401

STANDARD DEVIATION= .0942

COEFF OF SKEWNESS= +.0360

COEFF OF KURTOSIS= 2.1438

CHI-SQUARED= 75.0988

MEDIAN X VALUE= 219.8400

CELL WIDTH= .028235

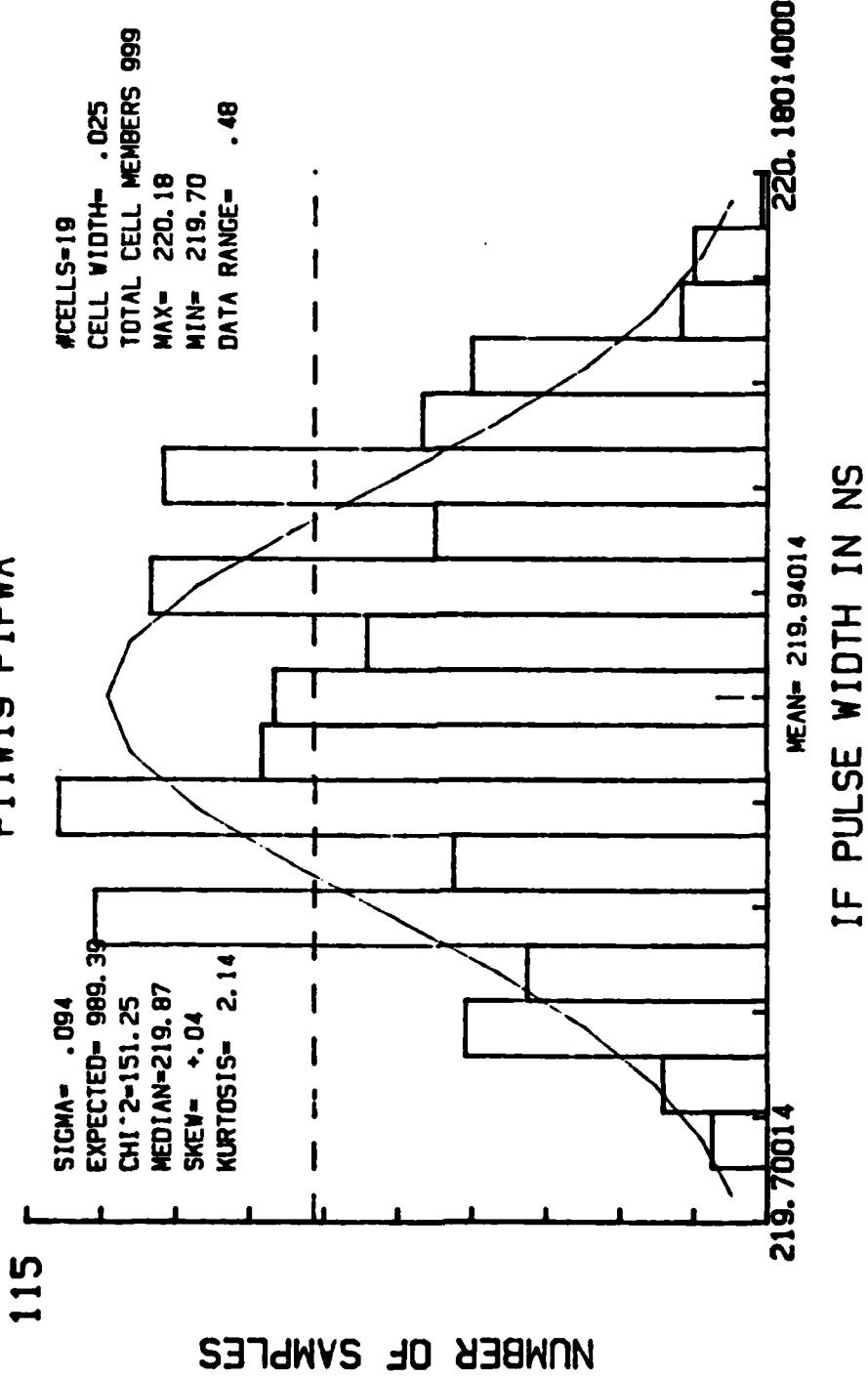
DATA RANGE= .480

SUM ACTUAL= 999

SUM EXPECTED= 989.4464

63.5 PERCENT OF DATA LIES BETWEEN 219.84 AND 220.04

HISTOGRAM FOR 1000 SAMPLES
P1I1W19 P1PWA



FILE PLIW19

PLOT MIN= 219.70 PLOT MAX= 220.18
DATA MIN= 219.70 DATA MAX= 220.18

CELL #	CENTER	# SAMPLES	EXPECTED
1	219.71	0	5.814
2	219.74	9	10.713
3	219.76	17	18.371
4	219.79	49	29.319
5	219.81	39	43.543
6	219.84	109	60.181
7	219.86	51	77.406
8	219.89	115	92.651
9	219.91	82	103.204
10	219.94	80	106.983
11	219.97	65	103.204
12	219.99	100	92.651
13	220.02	54	77.406
14	220.04	98	60.181
15	220.07	56	43.543
16	220.09	48	29.319
17	220.12	14	18.371
18	220.14	12	10.713
19	220.17	1	5.814

MEAN VALUE= 219.9401

STANDARD DEVIATION= .0942

COEFF OF SKEWNESS= +.0360

COEFF OF KURTOSIS= 2.1438

CHI-SQUARED=151.2526

MEDIAN X VALUE= 219.8700

CELL WIDTH= .025263

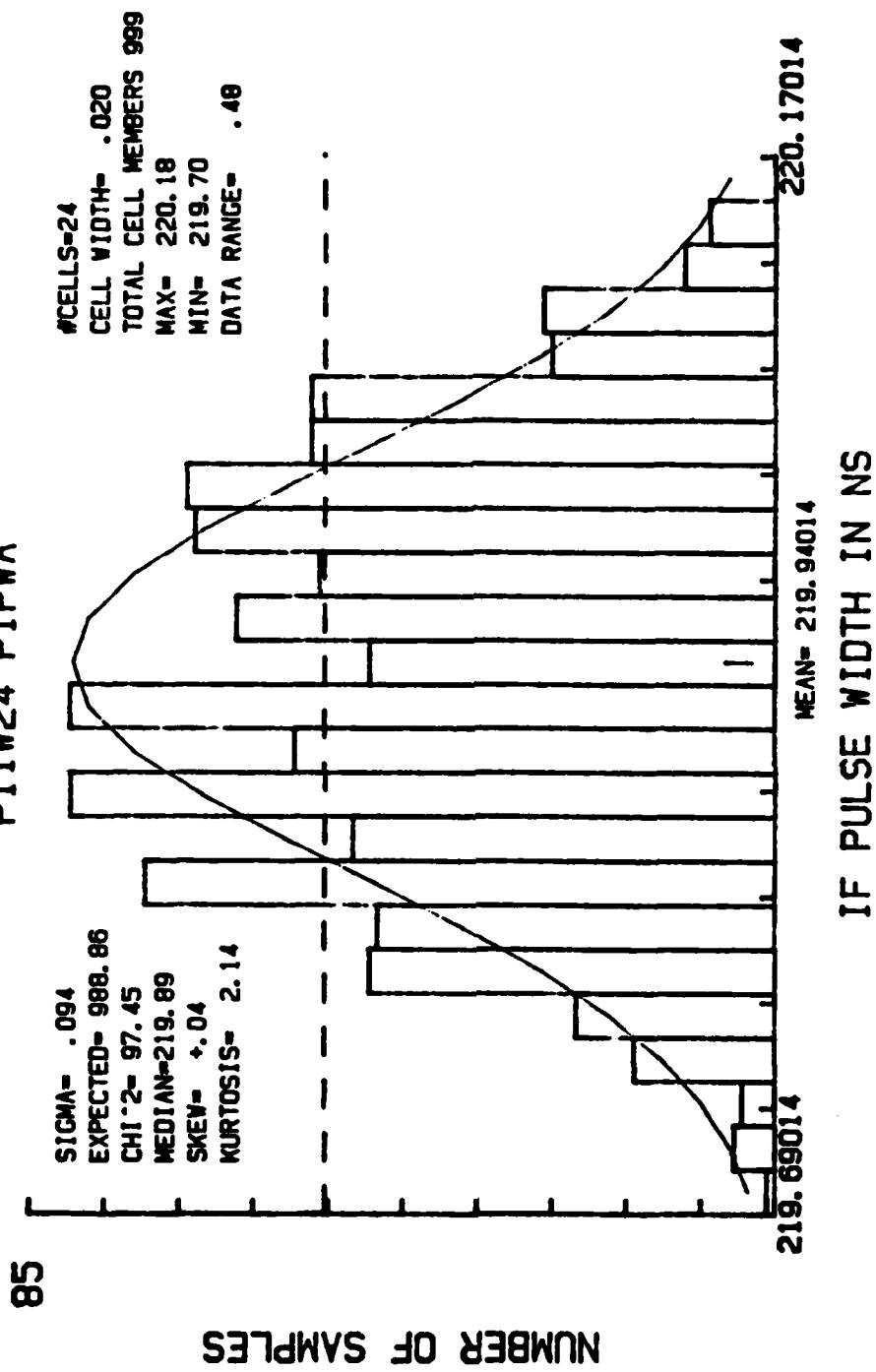
DATA RANGE= .480

SUM ACTUAL= 999

SUM EXPECTED= 989.3682

54.8 PERCENT OF DATA LIES BETWEEN 219.85 AND 220.03

HISTOGRAM FOR 1000 SAMPLES
P1IW24 P1PWA



FILE P11W24

PLOT MIN= 219.69 PLOT MAX= 220.17
 DATA MIN= 219.70 DATA MAX= 220.18

CELL #	CENTER	# SAMPLES	EXPECTED
1	219.70	1	3.300
2	219.72	5	5.542
3	219.74	4	8.895
4	219.76	17	13.649
5	219.78	24	20.021
6	219.80	49	28.073
7	219.82	48	37.629
8	219.84	76	48.215
9	219.86	51	59.056
10	219.88	85	69.147
11	219.90	58	77.394
12	219.92	85	82.807
13	219.94	49	84.695
14	219.96	65	82.807
15	219.98	55	77.394
16	220.00	70	69.147
17	220.02	71	59.056
18	220.04	56	48.215
19	220.06	56	37.629
20	220.08	27	28.073
21	220.10	28	20.021
22	220.12	11	13.649
23	220.14	8	8.895
24	220.16	0	5.542

MEAN VALUE= 219.9401

STANDARD DEVIATION= .0942

COEFF OF SKEWNESS= +.0360

COEFF OF KURTOSIS= 2.1438

CHI-SQUARED= 97.4548

MEDIAN X VALUE= 219.8900

CELL WIDTH= .020000

DATA RANGE= .480

SUM ACTUAL= 999

SUM EXPECTED= 988.8559

59.0 PERCENT OF DATA LIES BETWEEN 219.85 AND 220.03

Pulsewidth Sampled Data - P1PWB

The statistical results of pulsewidth sampled data P1PWB are presented on the next 5 pages. Histogram time plot, histograms with selected number of cells, and statistical analysis are presented.

The test results section of this report contains summary statistical information associated with this pulsewidth data set.

HISTOGRAM TIME PLOT
IF PULSE WIDTH P1PWB

219.77

TIME IN NANoseconds

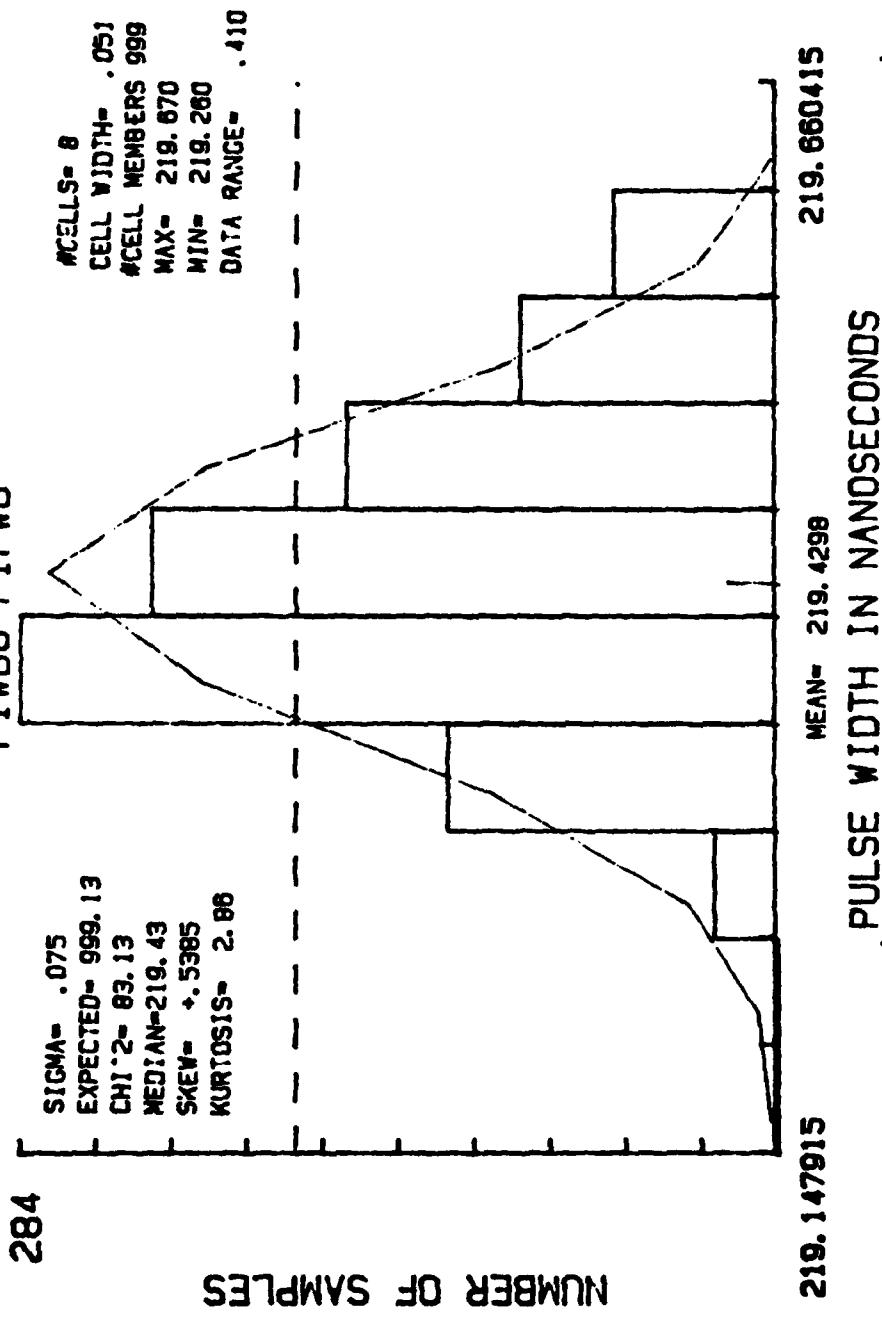
219.16

RELATIVE TIME

C-15

HISTOGRAM FOR 1000 SAMPLES

P1WBB P1PWB

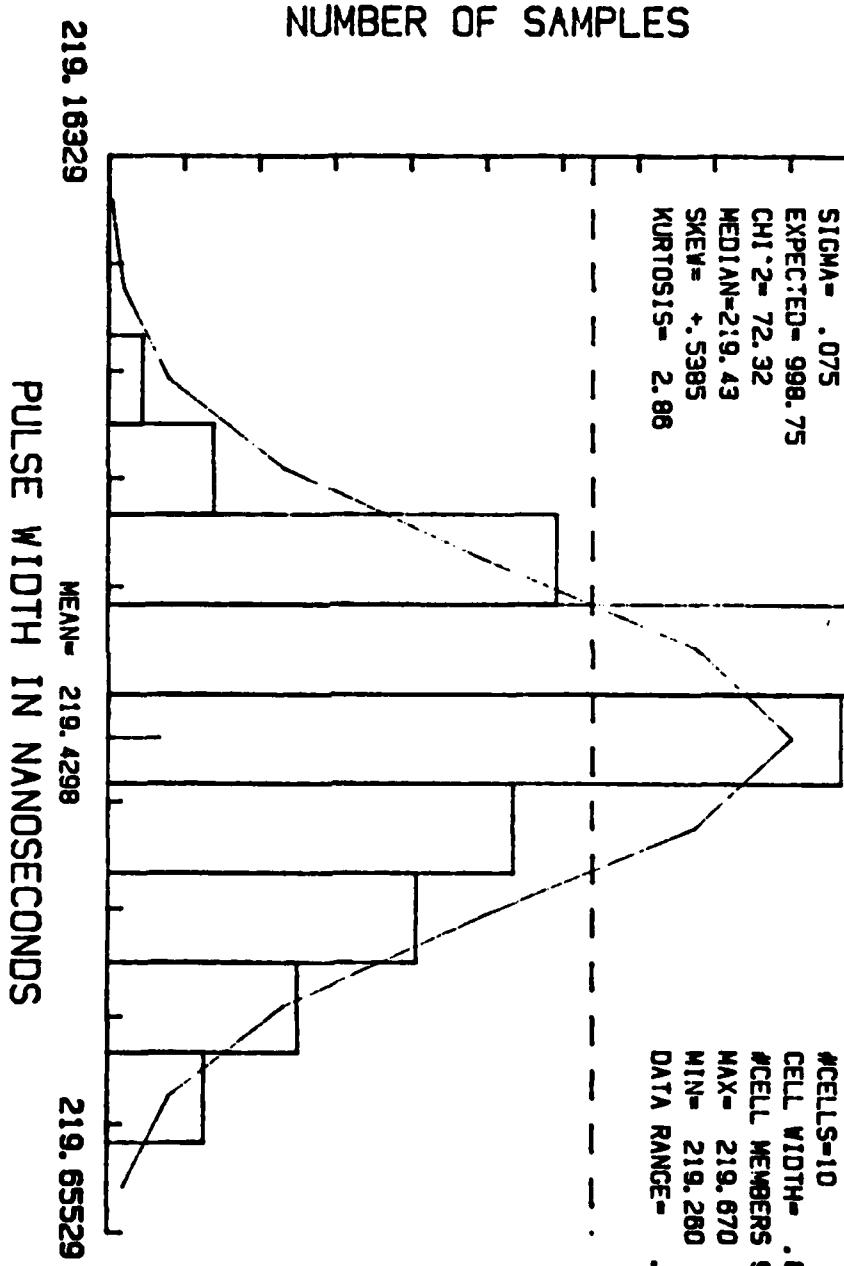


HISTOGRAM FOR 1000 SAMPLES

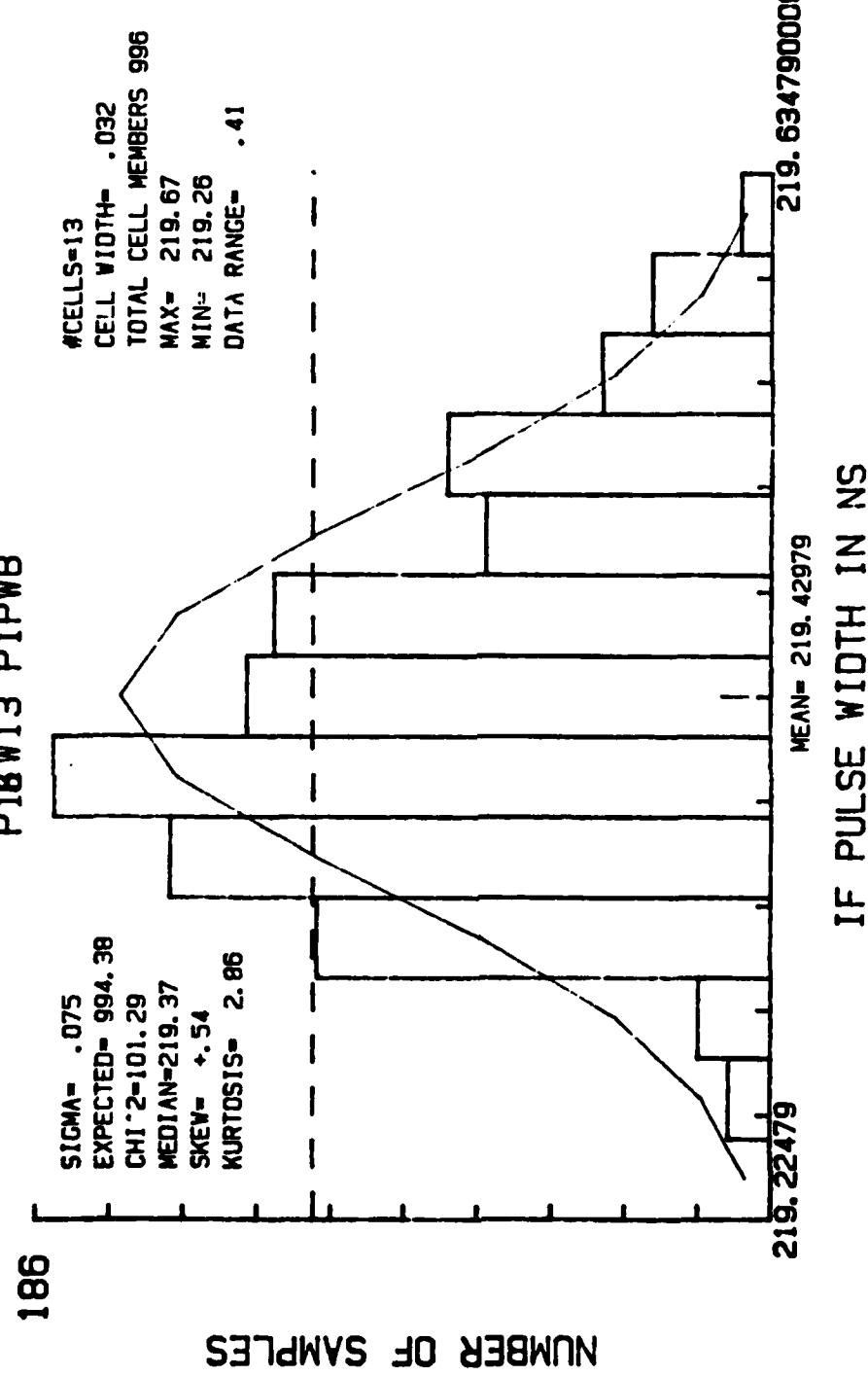
243

P1WB10 P1PWB

NUMBER OF SAMPLES



HISTOGRAM FOR 1000 SAMPLES
P18 W13 P1PWB



FILE P1BW13

PLOT MIN= 219.22 PLOT MAX= 219.63
DATA MIN= 219.26 DATA MAX= 219.67

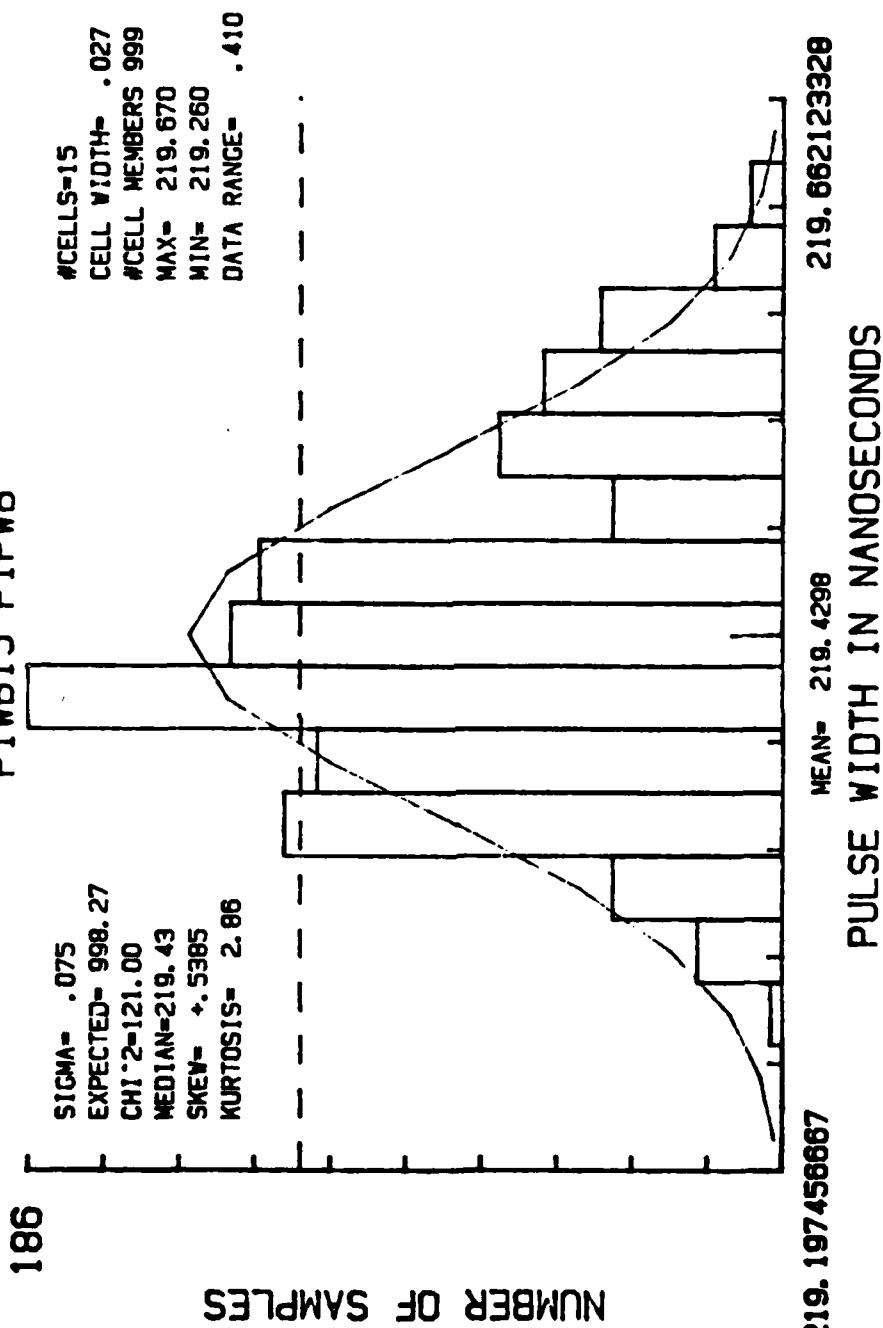
CELL #	CENTER	# SAMPLES	EXPECTED
1	219.24	0	6.747
2	219.27	11	18.042
3	219.30	19	40.345
4	219.34	118	75.445
5	219.37	156	117.979
6	219.40	186	154.279
7	219.43	136	168.710
8	219.46	129	154.279
9	219.49	74	117.979
10	219.52	84	75.445
11	219.56	44	40.345
12	219.59	31	18.042
13	219.62	8	6.747

MEAN VALUE= 219.4298
STANDARD DEVIATION= .0746
COEFF OF SKEWNESS= +.5385
COEFF OF KURTOSIS= 2.8618
CHI-SQUARED=101.2850
MEDIAN X VALUE= 219.3700
CELL WIDTH= .031538
DATA RANGE= .410
SUM ACTUAL= 996
SUM EXPECTED= 994.3835

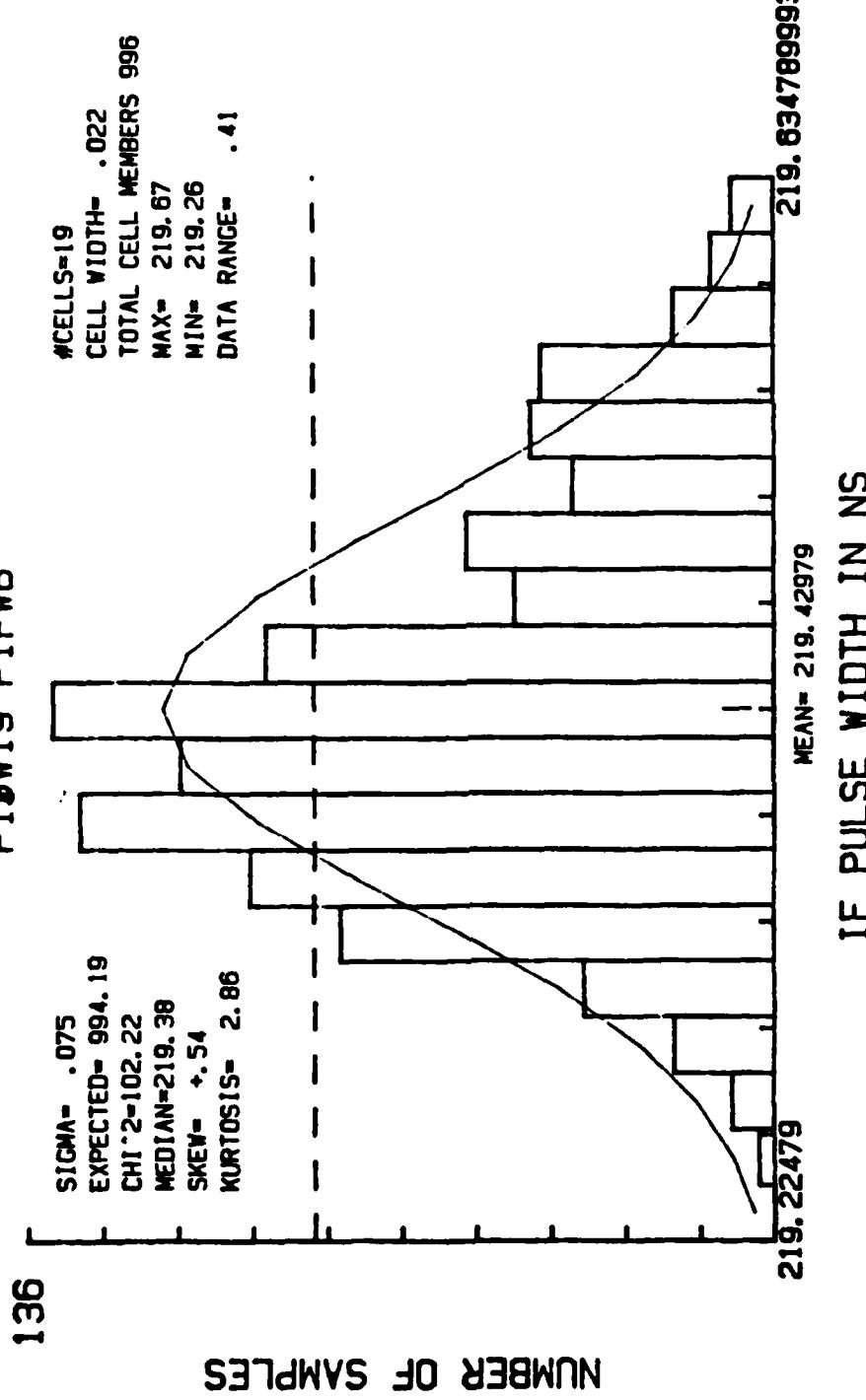
60.9PERCENT OF DATA LIES BETWEEN 219.35 AND 219.48

HISTOGRAM FOR 1000 SAMPLES

P1WB15 P1PWB



HISTOGRAM FOR 1000 SAMPLES
P1BW19 P1PWB



FILE PLBW19

PLOT MIN= 219.22 PLOT MAX= 219.63
DATA MIN= 219.26 DATA MAX= 219.67

CELL #	CENTER	# SAMPLES	EXPECTED
1	219.24	0	3.888
2	219.26	3	7.921
3	219.28	8	14.843
4	219.30	19	25.577
5	219.32	36	40.535
6	219.34	82	59.081
7	219.37	99	79.197
8	219.39	131	97.636
9	219.41	112	110.701
10	219.43	136	115.433
11	219.45	96	110.701
12	219.47	49	97.636
13	219.49	58	79.197
14	219.52	38	59.081
15	219.54	46	40.535
16	219.56	44	25.577
17	219.58	19	14.843
18	219.60	12	7.921
19	219.62	8	3.888

MEAN VALUE= 219.4298

STANDARD DEVIATION= .0746

COEFF OF SKEWNESS= +.5385

COEFF OF KURTOSIS= 2.8618

CHI-SQUARED=102.2167

MEDIAN X VALUE= 219.3800

CELL WIDTH= .021579

DATA RANGE= .410

SUM ACTUAL= 996

SUM EXPECTED= 994.1917

52.6PERCENT OF DATA LIES BETWEEN 219.38 AND 219.48

APPENDIX D

Introduction

ELINT parameter test results are contained in this appendix for the ELINT PRI parameter associated with the AN/PPS-6 radar. Two sets of the PRI sampled data were collected and the analyzed results are presented in this appendix. The PRI data sets are labelled P1RRA and P1RRB.

PRI Sampled Data - P1RRA

The statistical results of PRI sampled data P1RRA are presented on the next several pages. Histogram time plot, histograms with selected number of cells, and statistical analysis are presented.

The test results section of this report contains summary statistical information associated with this PRI data set.

HISTOGRAM TIME PLOT
PIRRA. HDATRW

499. 542

TIME IN MICROSECONDS

1
0
499. 518

RELATIVE TIME

D-3

HISTOGRAM FOR 7 CELLS

P1RIA7

SIGMA= .003
EXPECTED= 988.60
CHI^2= 26.03
MEDIAN= 0.00
SKEW= +.04
KURTOSIS= 2.31

#CELLS= 7
CELL WIDTH= .002
TOTAL CELL MEMBERS 999
MAX= 499.537
MIN= 499.523
DATA RANGE= .014

NUMBER OF SAMPLES

499.522559 499.529559 499.536559

PRI IN MICROSECONDS

FILE P1RIA7.NEWPNA

PLOT MIN= 499.5226 PLOT MAX= 499.5366
DATA MIN= 499.5230 DATA MAX= 499.5370

CELL #	CENTER	# SAMPLES	EXPECTED
1	499.5236	35	29.619
2	499.5256	134	103.663
3	499.5276	235	219.816
4	499.5296	221	282.404
5	499.5316	228	219.816
6	499.5336	116	103.663
7	499.5356	30	29.619

MEAN VALUE= 499.5296

STANDARD DEVIATION= .0028

COEFF OF SKEWNESS= +.0425

COEFF OF KURTOSIS= 2.3073

CHI-SQUARED= 26.0335

MEDIAN X VALUE= 0.0000

CELL WIDTH= .002000

PLOT RANGE= .0140

SUM ACTUAL= 999

SUM EXPECTED= 988.5989

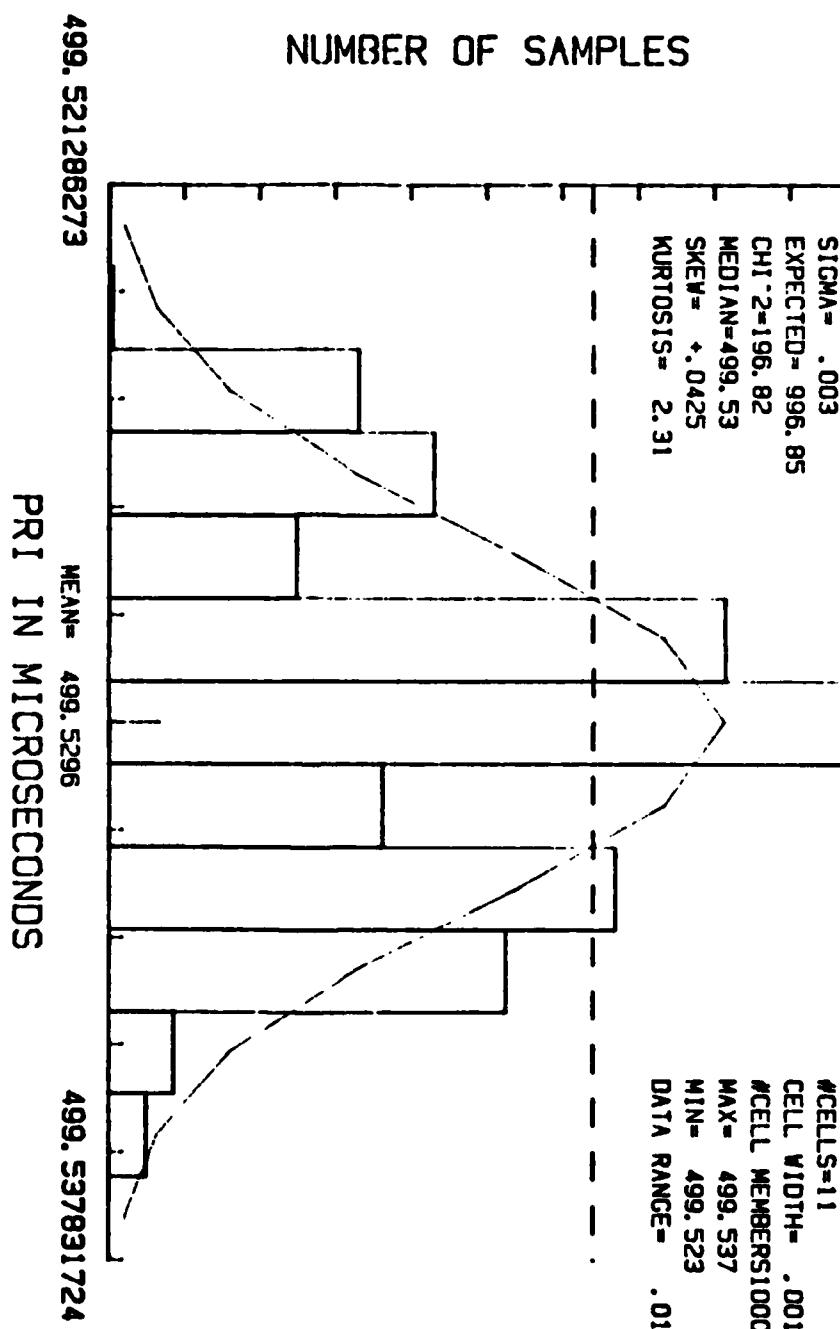
68.5 PERCENT OF DATA LIES BETWEEN 499.5266 AND 499.5326

HISTOGRAM FOR 1000 SAMPLES

221

PRIA11 P1RRA

NUMBER OF SAMPLES



FILE PRIALL.SVALF

PLOT MIN= 499.5213 PLOT MAX= 499.5378
DATA MIN= 499.5230 DATA MAX= 499.5370

CELL #	CENTER	# SAMPLES	EXPECTED
1	499.5219	0	4.659
2	499.5232	1	14.222
3	499.5245	73	35.445
4	499.5257	95	72.110
5	499.5270	55	119.762
6	499.5283	180	162.372
7	499.5296	221	179.711
8	499.5308	80	162.372
9	499.5321	148	119.762
10	499.5334	116	72.111
11	499.5346	19	35.445
12	499.5359	11	14.222
13	499.5372	1	4.659

MEAN VALUE= 499.5296

STANDARD DEVIATION= .0028

COEFF OF SKEWNESS= +.0425

COEFF OF KURTOSIS= 2.3073

CHI-SQUARED=196.8211

MEDIAN X VALUE= 499.5296

CELL WIDTH= .001273

PLOT RANGE= .0165

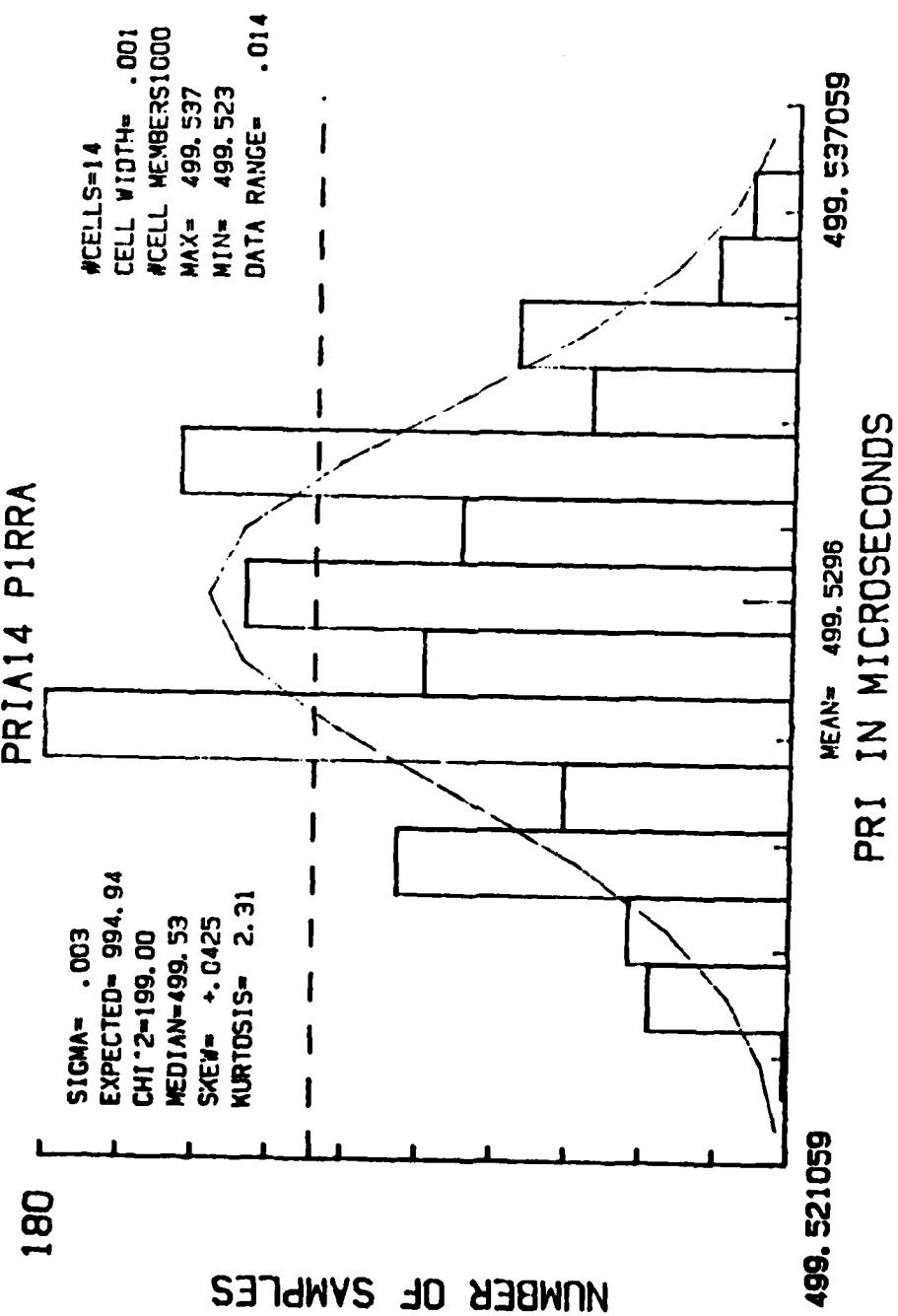
SUM ACTUAL=1000

SUM EXPECTED= 996.8519

62.9PERCENT OF DATA LIES BETWEEN 499.5276 AND 499.5327

D-7

HISTOGRAM FOR 1000 SAMPLES
PRI14 P1RRA



D- 8

FILE PRIA14.SVALF

PLOT MIN= 499.5211 PLOT MAX= 499.5371
DATA MIN= 499.5230 DATA MAX= 499.5370

CELL #	CENTER	# SAMPLES	EXPECTED
1	499.5216	0	2.564
2	499.5226	1	6.560
3	499.5236	34	14.809
4	499.5246	39	29.496
5	499.5256	95	51.832
6	499.5266	55	80.355
7	499.5276	180	109.908
8	499.5286	89	132.629
9	499.5296	132	141.202
10	499.5306	80	132.629
11	499.5316	148	109.908
12	499.5326	49	80.355
13	499.5336	67	51.832
14	499.5346	19	29.496
15	499.5356	11	14.809
16	499.5366	1	6.560

MEAN VALUE= 499.5296

STANDARD DEVIATION= .0028

COEFF OF SKEWNESS= +.0425

COEFF OF KURTOSIS= 2.3073

CHI-SQUARED=198.9988

MEDIAN X VALUE= 499.5296

CELL WIDTH= .001000

PLOT RANGE= .0160

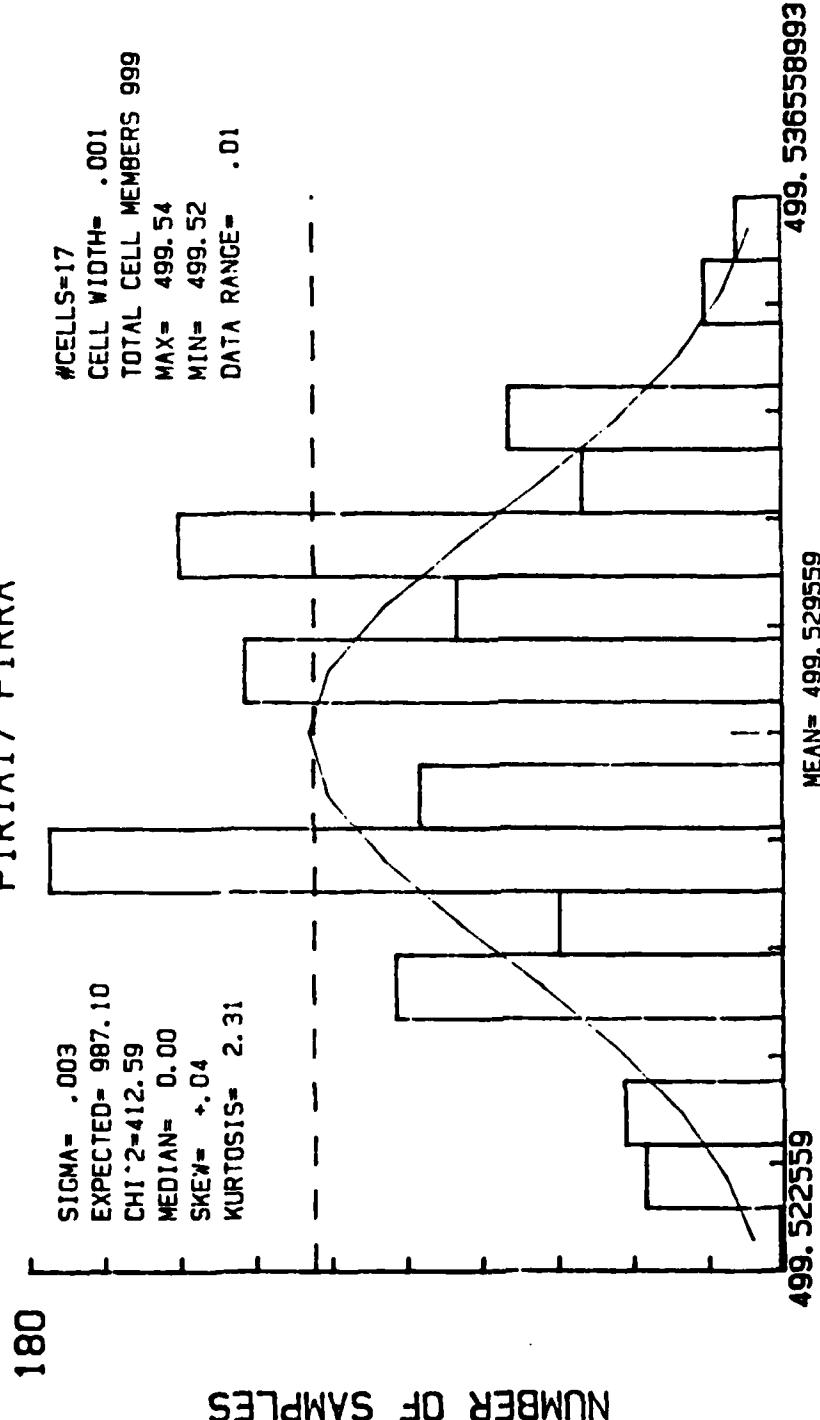
SUM ACTUAL=1000

SUM EXPECTED= 994.9436

62.9PERCENT OF DATA LIES BETWEEN 499.5271 AND 499.5321

HISTOGRAM FOR 1000 SAMPLES

P1RIA17 P1RRA



FILE P1R1A17.NEWPNA

PLOT MIN= 499.5226 PLOT MAX= 499.5366
DATA MIN= 499.5230 DATA MAX= 499.5370

CELL #	CENTER	# SAMPLES	EXPECTED
1	499.5230	1	7.670
2	499.5238	34	14.505
3	499.5246	39	25.197
4	499.5254	0	40.206
5	499.5263	95	58.930
6	499.5271	55	79.337
7	499.5279	180	98.112
8	499.5287	89	111.447
9	499.5296	0	116.284
10	499.5304	132	111.448
11	499.5312	80	98.112
12	499.5320	148	79.338
13	499.5329	49	58.930
14	499.5337	67	40.206
15	499.5345	0	25.197
16	499.5353	19	14.505
17	499.5361	11	7.670

MEAN VALUE= 499.5296

STANDARD DEVIATION= .0028

COEFF OF SKEWNESS= +.0425

COEFF OF KURTOSIS= 2.3073

CHI-SQUARED=412.5863

MEDIAN X VALUE= 0.0000

CELL WIDTH= .000824

PLOT RANGE= .0140

SUM ACTUAL= 999

SUM EXPECTED= 987.0954

63.0 PERCENT OF DATA LIES BETWEEN 499.5275 AND 499.5324

PRI Sampled Data - P1RRB

The statistical results of PRI sampled data P1RRB are presented on the following pages. Histogram time plot, histograms with selected number of cells, and statistical analysis are presented.

The test results section of this report contains summary statistical information associated with this PRI data set.

HISTOGRAM TIME PLOT
P1RRB. HDATRW

499. 519

TIME IN MICROSECONDS



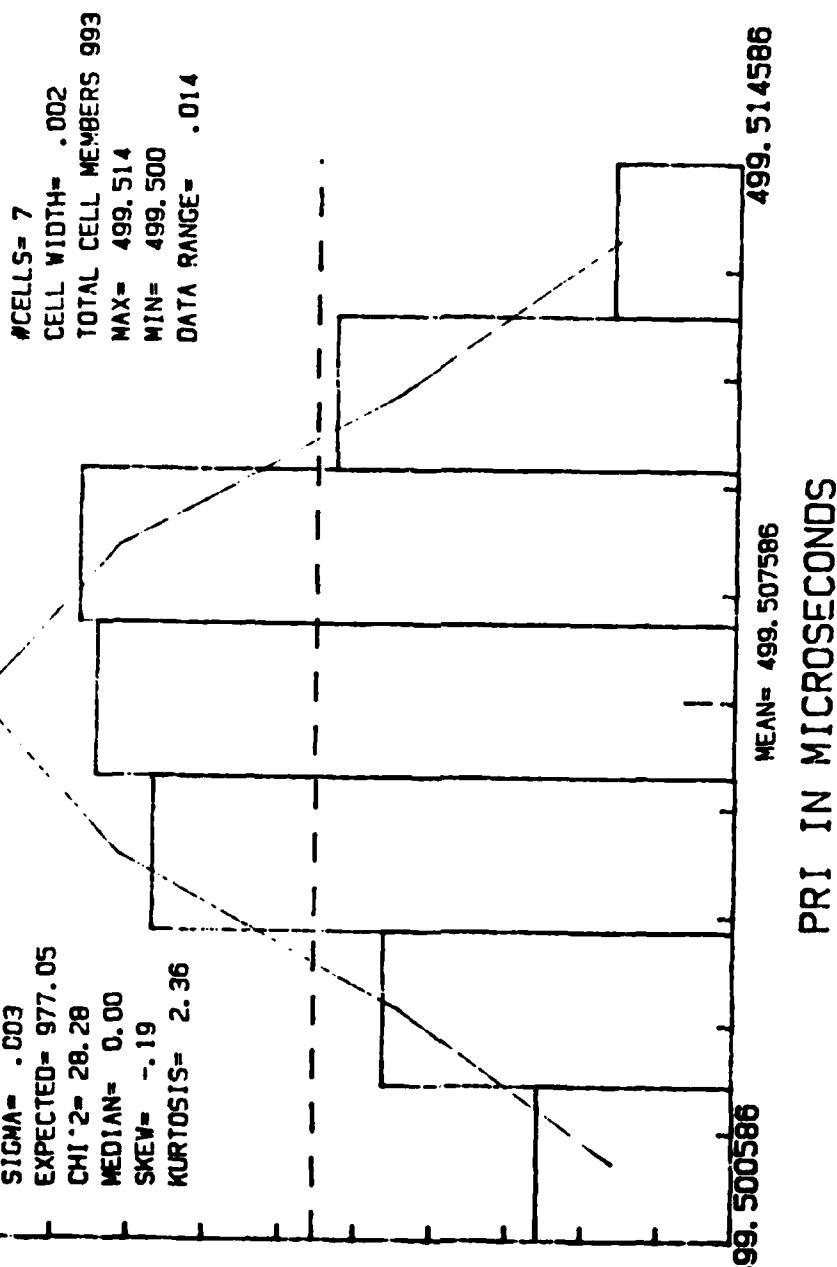
0-13

HISTOGRAM FOR 1000 SAMPLES

P1RIB7 P1RRB

22

SIGMA= .003
 EXPECTED= 977.05
 CHI²= 28.28
 MEDIAN= 0.00
 SKEW= -.19
 KURTOSIS= 2.36



D- 14

FILE P1RIB7.NEWPNA

PLOT MIN= 499.5006 PLOT MAX= 499.5146
DATA MIN= 499.5000 DATA MAX= 499.5140

CELL #	CENTER	# SAMPLES	EXPECTED
1	499.5016	66	40.636
2	499.5036	118	112.685
3	499.5056	196	207.795
4	499.5076	215	254.815
5	499.5096	221	207.795
6	499.5116	135	112.685
7	499.5136	42	40.636

MEAN VALUE= 499.5076

STANDARD DEVIATION= .0031

COEFF OF SKEWNESS= -.1889

COEFF OF KURTOSIS= 2.3572

CHI-SQUARED= 28.2762

MEDIAN X VALUE= 0.0000

CELL WIDTH= .002000

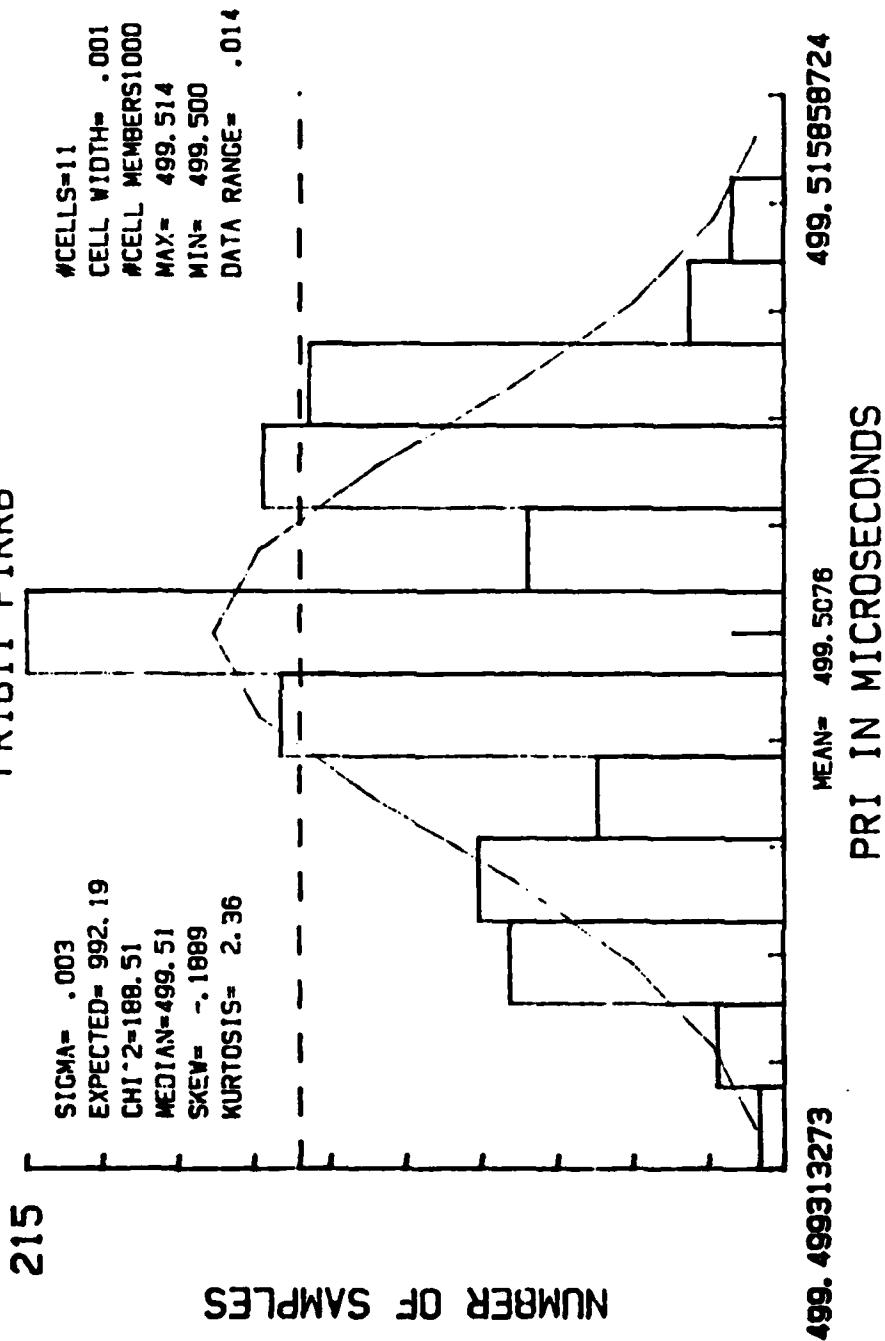
PLOT RANGE= .0140

SUM ACTUAL= 993

SUM EXPECTED= 977.0476

63.6 PERCENT OF DATA LIES BETWEEN 499.5046 AND 499.5106

HISTOGRAM FOR 1000 SAMPLES
PRIB11 P1RRB



FILE PRIB11.SVALF

PILOT MIN= 499.4993 PILOT MAX= 499.5159
DATA MIN= 499.5000 DATA MAX= 499.5140

CELL #	CENTER	# SAMPLES	EXPECTED
1	499.4999	7	8.287
2	499.5012	19	20.561
3	499.5025	78	43.244
4	499.5038	87	77.100
5	499.5050	53	116.528
6	499.5063	143	149.298
7	499.5076	215	162.155
8	499.5089	73	149.298
9	499.5101	148	116.528
10	499.5114	135	77.100
11	499.5127	27	43.244
12	499.5139	15	20.561
13	499.5152	0	8.287

MEAN VALUE= 499.5076
STANDARD DEVIATION= .0031
COEFF OF SKEWNESS= -.1889
COEFF OF KURTOSIS= 2.3572
CHI-SQUARED=188.5121
MEDIAN X VALUE= 499.5076
CELL WIDTH= .001273
PLOT RANGE= .0165
SUM ACTUAL=1000
SUM EXPECTED= 992.1925

57.9 PERCENT OF DATA LIES BETWEEN 499.5057 AND 499.5108

D-17

HISTOGRAM FOR 1000 SAMPLES

P1RIB14 P1RRB

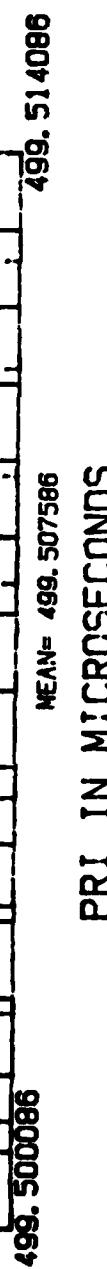
148

SIGMA=.003
EXPECTED= 973.38
CHI^2=161.18
MEDIAN=499.51
SKEW=.19
KURTOSIS= 2.36

#CELLS=14
CELL WIDTH=.001
TOTAL CELL MEMBERS 993
MAX= 499.514
MIN= 499.500
DATA RANGE=.014

NUMBER OF SAMPLES

148



FILE P1RIB14.NEWPNA

PLOT MIN= 499.5001 PLOT MAX= 499.5141
DATA MIN= 499.5000 DATA MAX= 499.5140

CELL #	CENTER	# SAMPLES	EXPECTED
1	499.5006	19	10.471
2	499.5016	47	20.318
3	499.5026	31	35.605
4	499.5036	87	56.342
5	499.5046	53	80.513
6	499.5056	143	103.898
7	499.5066	69	121.073
8	499.5076	146	127.408
9	499.5086	73	121.073
10	499.5096	148	103.898
11	499.5106	60	80.513
12	499.5116	75	56.342
13	499.5126	27	35.605
14	499.5136	15	20.318

MEAN VALUE= 499.5076

STANDARD DEVIATION= .0031

COEFF OF SKEWNESS= -.1889

COEFF OF KURTOSIS= 2.3572

CHI-SQUARED=161.1768

MEDIAN X VALUE= 499.5050

CELL WIDTH= .001000

PLOT RANGE= .0140

SUM ACTUAL= 993

SUM EXPECTED= 973.3766

58.3PERCENT OF DATA LIES BETWEEN 499.5051 AND 499.5101

D-19

HISTOGRAM FOR 1000 SAMPLES

PRI B17 P1RRB

148

SIGMA=.003
EXPECTED= 987.78
CHI^2=404.20
MEDIAN=499.51
SKEW= -.1889
KURTOSIS= 2.36

#CELLS=17
CELL WIDTH=.001
#CELL MEMBERS 1000
MAX= 499.514
MIN= 499.500
DATA RANGE=.014

NUMBER OF SAMPLES

v- 20

499.499762471
499.515409522
MEAN= 499.5076
PRI IN MICROSECONDS

FILE PR1B17.SVALF

PLOT MIN= 499.4998 PLOT MAX= 499.5154
DATA MIN= 499.5000 DATA MAX= 499.5140

CELL #	CENTER	# SAMPLES	EXPECTED
1	499.5002	7	6.371
2	499.5010	19	11.470
3	499.5018	47	19.270
4	499.5026	31	30.209
5	499.5035	0	44.194
6	499.5043	87	60.332
7	499.5051	53	76.858
8	499.5059	143	91.368
9	499.5068	69	101.357
10	499.5076	0	104.924
11	499.5084	146	101.357
12	499.5092	73	91.368
13	499.5101	148	76.858
14	499.5109	60	60.332
15	499.5117	75	44.194
16	499.5125	0	30.209
17	499.5134	27	19.270
18	499.5142	15	11.470
19	499.5150	0	6.371

MEAN VALUE= 499.5076

STANDARD DEVIATION= .0031

COEFF OF SKEWNESS= -.1889

COEFF OF KURTOSIS= 2.3572

CHI-SQUARED= 404.2004

MEDIAN X VALUE= 499.5084

CELL WIDTH= .000824

PLOT RANGE= .0156

SUM ACTUAL=1000

SUM EXPECTED= 987.7818

57.9PERCENT OF DATA LIES BETWEEN 499.5055 AND 499.5105